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VOL.18 NO.13 JULY 1999

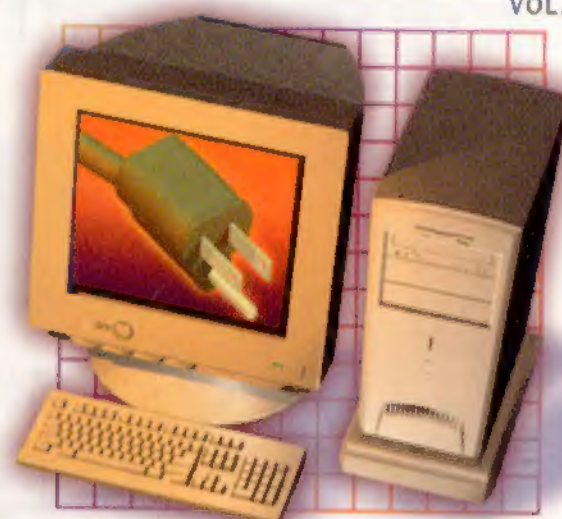
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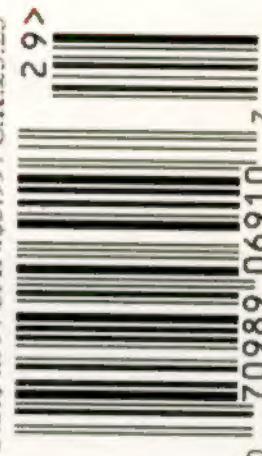


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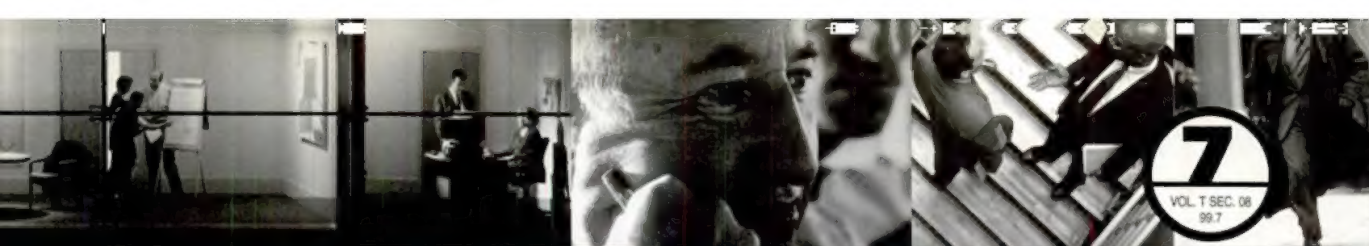
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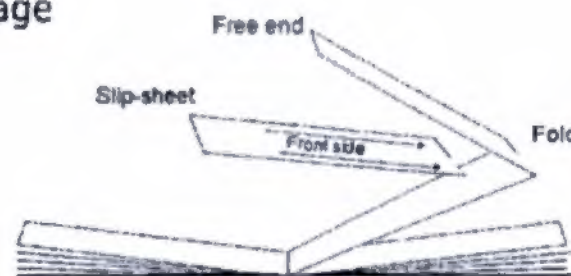
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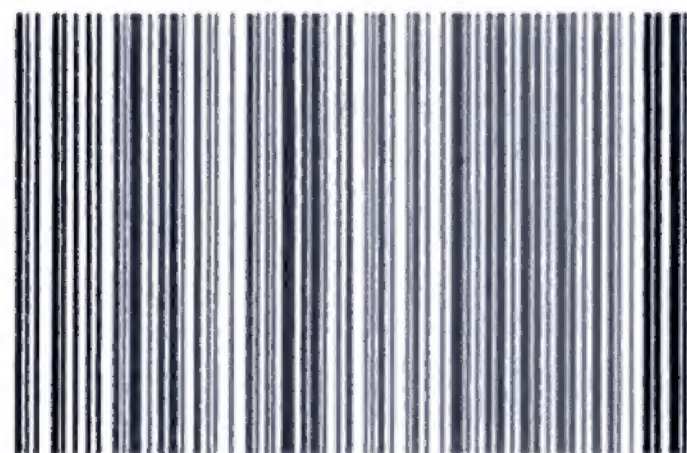
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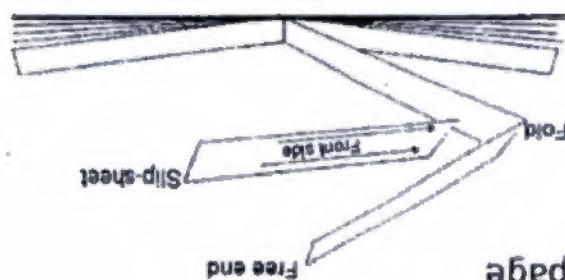
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PC Computing April 1999



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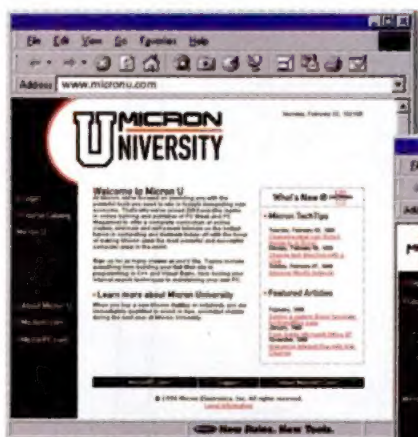
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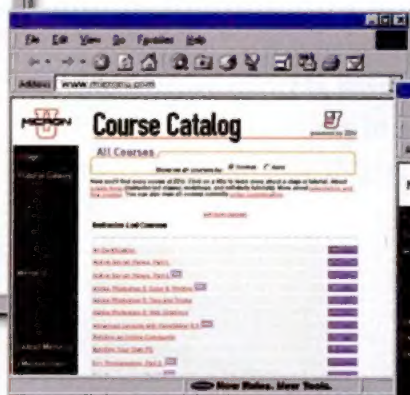
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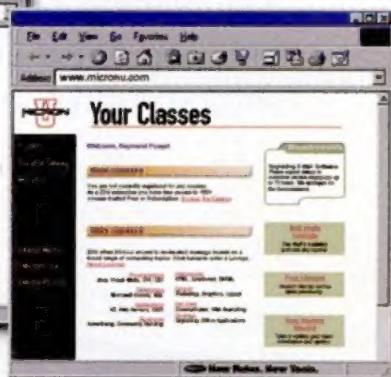
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The Web as a New Art Form

I've seen a lot of applications of the Internet, but every once in a while I still run across something that makes me go "Wow!" Usually, it's some cool new technology that is unlike anything I've seen before, or a new Net-based business that really changes the way we work. I had an opportunity recently to

talk with some people who are on the verge of creating a new art form, one in which the Web could play an integral role. I'm talking about hypertext-based fiction and poetry, which may reinvent creative writing.

Creative writing is one discipline that really has not been changed much by technology. Yes, word processing has changed the writing and editing processes for many books, and new printing and distribution technologies (including electronic commerce) have changed how books are sold. But in most respects, the final product isn't all that different from the way it was 50 or 100 years ago. We still read the linear kind of story people have been writing throughout recorded history.

I recently came away from a forum at Brown University entitled "Technology Platforms for the 21st Century" convinced that it doesn't have to be that way. New technologies now offer the possibility of changing methods of telling stories and writing fiction and poetry.

The forum, hosted by novelist Robert Coover, focused on the interaction of writers and technology. Half the attendees showed products or talked about what technology has to offer. The other half did something far more interesting: They showed off hypertext-based creative writing and talked about what they needed from technology.

The examples were fascinating. Deena Larson's "Ferris Wheels" showed different parts of a story depending on where on the wheel you clicked, and the order of your clicks changed your perception of the work. Bill Bly's "We Descend" used hypertext and a set of images as a way of expanding and changing the story. A group of authors gave a reading of a funny hypertext novel called "The Unknown," which had different tracks you move among. Rob Wittig's "Fall of the Site of Marsha" used the changes in Web pages to tell a story. (Check the online version of this column for links to these stories and other resources.)

I didn't care for every story or poem, and I certainly don't expect or want hypertext-based fiction to replace novels or poems. But that's not the point. This all shows ways in which technology can change the whole process of reading fiction. And it isn't just one new model of creative writing, it is a whole host of new methods.

Not all of the works were created for the Internet. In fact, many of the authors are partial to a program called Storyspace, from Eastgate Systems, which allows a great deal of flexibility in things like page layout and design.

These authors are creating more works that can be read on the Web, because they want to reach a wider audience. Still, many were unhappy with the tools for creating Internet-based hypertexts. Though we saw demonstrations of a number of interesting tools, ranging from The Brain to Trellox to Vignette's StoryServer, none are designed specifically for the hyperfiction author.

In fact, some authors were skeptical of or openly hostile to HTML, because it doesn't allow for the flexibility of character placement or the number of different actions they would like. Could the Web and Web creation tools evolve

in a way that is more comfortable for creative writing? Absolutely. Will they? For the most part probably not, because most of the people designing tools or setting standards seem to be more concerned with programmers or business users.

Still, that may not matter. Authors either will find new ways of using existing tools or will create their own tools. That's always been the case.

Like much of the Web, hypertext-based creative writing is still quite primitive. Compared with the medium's potential, it's like the Wright brothers' airplane compared with today's aircraft. But it's a fascinating example of the way the Web is helping to spawn a new art form with new tools, a new audience, and new conventions for writing and reading. **PC**



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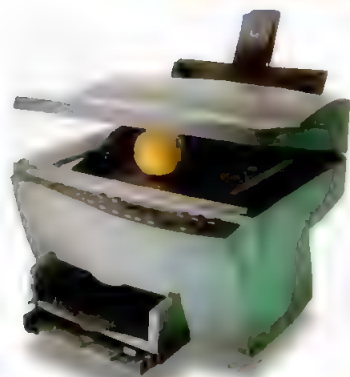
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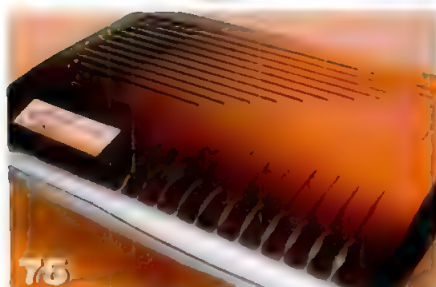
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Contents

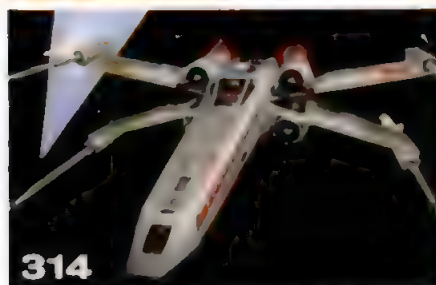
JULY 1999 Vol.18 No.13



66



75



314

ON THE COVER:

Exclusive reader ratings for:

■ Office, home, and notebook PCs. [Page 183](#)

■ Internet service providers. [Page 229](#)

■ Ink jet and laser printers. [Page 209](#)

■ Office suites, browsers, e-mail programs, and more. [Page 217](#)

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TRENDS

Bill payment on the Web	28
Big, bright flat panels	29
Inside PC Labs.....	29
Quantum dot computing	30
The best Web shopping bots	35
Site Finder: Law and the Workplace.....	36

FIRST LOOKS

Microsoft Windows 2000 Beta 3	37
Microsoft Windows 98 Second Edition	39
Microsoft Office 2000 Small Business Tools	48
IBM ThinkPad 240.....	48
Brother MP-21C Mobile Color Ink Jet Printer	48
AutoCAD 2000	49
eStoreBuilder for Drumbeat 2000.....	53
MetaCreations' Canoma	53

NETWORKING FIRST LOOKS

PictureTaker Express 2.0	75
StarGazer 1800 Router	75
3Com NBX 100 Communications System.....	76
SuperScout 2.5	77

OPINIONS

Michael J. Miller	4
Jake Kirchner	30
Bill Machrone	85
John C. Dvorak	87
John C. Dvorak's Inside Track	88
Jim Seymour	93
Bill Howard	97

SOLUTIONS

TUTOR239
MP3 files are the smart new way to exchange music. Here's how to create them.

USER TO USER.....243
Stop Word forms from expanding; drive letters for new disks; Excel and Access tips.

UTILITIES251
JumpTolt lends accessibility and organization to your favorite links.

INTERNET BUILDER253
Meta tags are a powerful tool for getting your Web site the attention it deserves.

PC TECH258
Build Web-based applications by exploiting IE5's dynamic HTML features.

AFTER HOURS

Mortgage Web sites303

More online at
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132

114

146

SPECIAL ISSUE

100 The Perfect PC

Perfection is subjective. Home user or road warrior, gamer or programmer, we'll help you choose your perfect PC.

THE POWER USER 102

The New Generation of Graphics Chips	106
Removable Storage Options	108
Power User Service and Support Policies	110

THE MOBILE USER 114

Hand-Held Companions	116
Mobile User Service and Support Policies	118
User Tips	120

THE CORPORATE USER 132

For the Road	134
Corporate User Service and Support Policies	138

THE HOME USER 146

For the Gamer	152
How to Network Your Home	157
Fast Connections Compared	157
Home User Service and Support Policies	164

THE TECHNICAL PRO USER 168

You Need	169
User Tips	169

THE CORPORATE IS MANAGER 170

Workgroup Network	175
Enterprise Network	176
Should You Outsource Important Network Services?	179
Authentication Options	180

183 READERS RATE SERVICE & RELIABILITY

Learn from your fellow readers which printer and PC vendors keep their customers satisfied—and which just keep them on hold.

DESKTOPS & NOTEBOOKS 183

Report Cards	183
Readers' Choice	184
PC Vendor Scores	187

PRINTERS 209

Report Card	209
Readers' Choice	210
Printer Vendor Scores	212

217 READERS RATE SUPPORT & SATISFACTION

Besides responding to our annual survey gauging their feelings on the software they're using, this year readers sound off on which ISPs they're happiest with.

SOFTWARE 217

The Top Office Suites	217
Software Scores: Overall Satisfaction	218
Software Scores: Technical Support	222

ISPs 229

Satisfaction by Connection	229
Reasons for Choosing an ISP	230
ISP Scores: Connections	234

PRODUCTS REVIEWED IN THIS ISSUE

First Looks: Multifunction Printers

Compaq A900 All-In-One	66
HP OfficeJet R60	66

First Looks: Additional Products

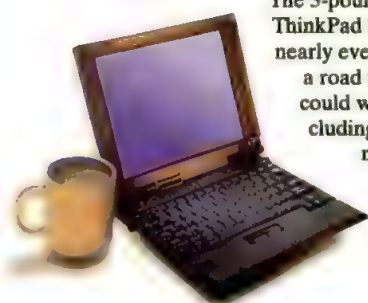
Netscape Communicator 4.6	56
Opera 3.60	56
ELetter	57
CorelDraw 9	60
Deep Paint	64
TextBridge Pro 9.0	64
Cult3D	71
CareerSteps	71

After Hours

E-Loan	304
iOwn	304
MSN HomeAdvisor	306
QuickenMortgage	310
Net.B@nk	304
Telebank	304
Star Wars: X-Wing alliance	314

ALSO IN THIS ISSUE

PIPELINE	9
LETTERS	21
SECOND LOOKS	80
MARKETPLACE	286
COMING UP	310
EDITORIAL PRODUCT INDEX	314
AD INDEX: COMPANIES	316
AD INDEX: PRODUCTS	318
ABORT, RETRY, FAIL?	324



The 3-pound IBM ThinkPad 240 has nearly everything a road warrior could want, including a 56K modem.

44

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Emotional Computing

One day in the not-so-distant future, your computer may know exactly how you feel. Big Brother overtones notwithstanding, researchers and psychologists at IBM's Almaden Research Center are working on several projects, collectively known as BlueEyes, which may one day enable computers and everyday appliances to interact with people in ways that are hard to imagine today.

For example, a mouse will be

able to sense emotional states with the help of an infrared detector that can pick up your heart rate through your thumb, a *thermosistor* chip will take your temperature, and fingertip sensors will pick up your galvanic skin response. Your computer will then correlate the results to your emotional state.

In other projects, researchers are looking into how computers can figure out your mood based on your facial expressions, the position of your eyebrows, and the corners of your mouth. Using

a camera and an infrared light source, the IBM Pupil Finder can figure out where you're looking. And Sutor (Simple User Interest Tracker) will keep in touch with your needs by watching what you do. For example, Sutor can watch the Web page you're browsing and offer additional information on the same topic.

The purpose of BlueEyes research is to endow computers with the perceptual abilities people take for granted. In turn, according to IBM, computers

will be able to use this information to be more productive, performing expected actions or providing expected information. IBM envisions the day

when televisions, refrigerators, and ovens will do their jobs when you look at them and speak to them. Such engagement requires computers to observe you carefully and to anticipate your actions and needs.

Whether you really want to have such a touchy-feely rapport with your computer is another question entirely.



A PC for Small Spaces

The upcoming NEC Z1 may look like a flat-panel display, but it's actually the whole shebang—a computer and a monitor in one. A fusion of desktop and notebook, the system will have a footprint of just 12 square inches and is intended for the home market. The 21-pound Z1

neatly hides its components—which include a 450-MHz Pentium III processor, 96MB of memory, a DVD-ROM drive, 8MB of video memory, built-in speakers, and four USB ports—behind its 15-inch display. The 8.4GB hard disk is housed in the base. NEC expects the Z1 to arrive on retail shelves in August at a price of \$2,400.



Fusion: The 21-pound NEC Z1 hides a 450-MHz chip and an 8.4GB hard disk inside its display.



Who's Wary of the Web?

Despite soaring use of the Internet by consumers and big businesses, many small businesses are holding back. Between 1998 and 1999, 427,000 small businesses obtained online access, according to the U.S. Small Business Internet Survey conducted by market research firm Cyber Dialogue. This figure represents only a 5 percent increase from last year, from 38 percent to 43 percent of all small businesses.

The survey indicates that despite the popularity and media coverage of the World Wide Web, a large segment of the small-business population still doesn't feel or is unaware of the need for online access.

"There are still lots of mom-and-pop shops out there that haven't the time, energy, or inclination to get online. Part of this is due to the fact that marketing campaigns have focused on the sales possibilities and get-rich-quick hype about the Web rather than on how to save money online. Many of these companies are unaware of the savings that online comparison shopping can bring in terms of travel, office supplies, books, and particularly financial services," says Thomas E. Miller, vice president at Cyber Dialogue. If small businesses could be made aware of how many ways they might save time and money through access to the World Wide Web, he says, they would soon be convinced to go online.

A Dot Com by Any Other Name...

On the Web, sometimes all you've got is your good name. Or your new name, it seems, as a number of established sites roll out new identities, usually on the verge of the inevitable Internet IPO. Why? Sometimes the old names are hard to remember or type in, or they are too limiting for expansion-hungry sites. Here are some of the most recent name changes.

OLD NAME	NEW NAME	WHAT YOU'LL FIND THERE	REASON FOR CHANGE
barnesandnoble.com	bn.com	An Internet bookseller	Would you rather type 2 letters or 14?
DejaNews	Deja.com	An online discussion network with easy access to newsgroup content	More than just newsgroups, Deja.com is now a word-of-mouth center to help you buy stuff
HomeShark	iOwn.com	A home-buying and mortgage hub	HomeShark sounds like roan shark. iOwn sounds like i own a new home
Jutvision	bamboo.com	360-degree tours of homes	Jutvision was too limiting. bamboo is fun, exciting, and internationally understood
MegaDepot.com	Onvia.com	Small-business services	MegaDepot = Wal-Mart clone? Onvia is meant to imply "on the road to success"
MiningCo	About.com	Hundreds of human-created topic guides	No longer just for mining the Net, the site is now about commerce, about community, and more
Wireless Dimension	Point.com	A guide to choosing and buying wireless products	The site helps you get to the point of a smart wireless purchase

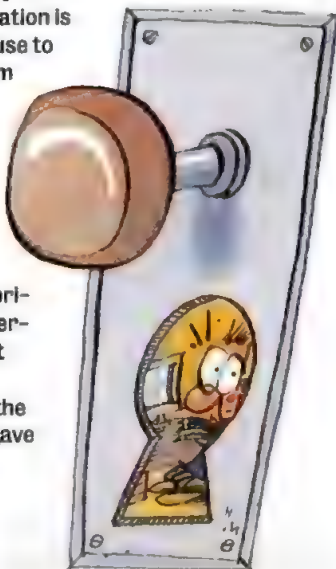
How Private Is Private?

The recent Georgetown Internet Privacy Policy Study—funded by the Internet industry in an effort to show the FTC that self-regulation is indeed working—revealed posted privacy policies at 94 percent of the top 100 Web sites and at 88 percent of all Web sites sampled. The figures sound reassuring but beg questions about the exact definitions of privacy policies.

The survey was conducted on 364 sites chosen randomly from the most-visited U.S. Web sites, which represent 98.8 percent of all Web traffic. A similar survey last year reported that only 14 percent of Web sites had online privacy policies. Last year, however, all registered Web sites were included, whereas this year's sampling was pared of all sites with minuscule traffic.

According to most privacy advocates, sites with comprehensive privacy policies notify their customers that their information is being collected, let them refuse to have it collected, permit them to review and change it, promise to keep it secure, and provide contact information for questions.

Of the 364 sites, even those with some sort of privacy policy (88 percent) may not provide the kind of privacy customers expect. 87 percent notified customers that they collect information, 77 percent offered customers the right of refusal, 40 percent gave customers access to their information, 46 percent promised security, and 49 percent provided contact information.



Deep Blue Grows Up

Remember chess grand master Garry Kasparov's loss to a supercomputer from IBM called Deep Blue? IBM has decided to extend the concept of tackling complex challenges with supercomputers beyond games by forming the Deep Computing Institute.

William R. Pulleyblank, director of Mathematical Sciences at IBM Research, defines *deep computing* as "supercomputer-scale processing initiatives that combine massive computation and very sophisticated software algorithms to attack problems previously beyond the reach of information technology. IBM considers it one of the primary trends driving the next stage of e-business."

The institute, based at IBM's T.J. Watson Research Center in New York, is already working on teaching supercomputers to use pattern-searching algorithms for *protein-folding*, a process that can lead to the invention of new drugs. Other projects on the table are teaching computers to optimize electronic transactions and to model weather patterns.

Top-Selling Retail Software

- 1 Norton AntiVirus 5.0 Symantec
 - 2 Microsoft Windows 98 Upgrade Microsoft
 - 3 TurboTax Intuit
 - 4 VirusScan 4.0 Classic Network Associates
 - 5 Norton System Works 2.0 Symantec
 - 6 Civilization: Call to Power Activision
 - 7 TurboTax Deluxe Intuit
 - 8 TurboTax 3.0 State Intuit
 - 9 Kiplinger TaxCut 1998 Filing Edition Block Financial
 - 10 Kiplinger TaxCut 1998 Deluxe Filing Edition Block Financial
- Source: PC Data, April 1999

Internet Rx

The online consumer health care market is expected to grow to \$1.7 billion by 2003, up from \$1 million in 1998, according to researchers at Jupiter Communications. Four forces will drive the market: (1) prescription drugs sold online, (2) over-the-counter drugs, (3) *nutraceuticals* (vitamins and so on), and (4) personal-care products.

Amazon.com recently entered the online pharmaceutical sales fray, and Netscape founder Jim Clark has started a company to facilitate online health care transactions and records-checking.



Webified Selling

Marking a milestone in the growth of the Internet economy, officials at several major technology companies including Intel and Oracle have recently said that they expect to generate all or nearly all of their sales online by next year.

At Oracle's recent iDevelop conference, CEO Larry Ellison said that Oracle aims to sell 100 percent of its software online, up from 10 percent now, as the new

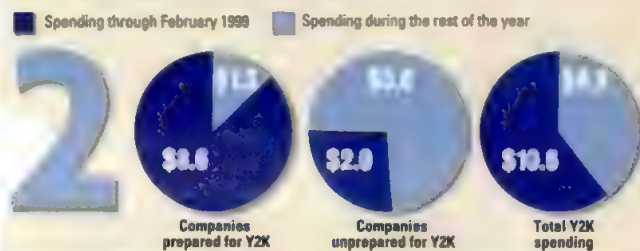
millennium arrives. "In one year, the only way you'll be able to order software from Oracle is through our Web store," said Ellison.

Intel has raised its Web sales revenues from almost nothing last summer to about \$1 billion a month now, according to senior vice president Sean Maloney. Intel's goal is similar to Oracle's: The company wants to generate nearly all of its sales online.

Oracle's Larry Ellison said that if his goal is reached by next year, Oracle could save \$500 million per year.

Y2K Catch-Up

The 3.3 million small businesses that are ill prepared for the millennium will spend the remainder of the year catching up, says market research firm IDC. The late-comers alone will spend \$5.6 billion through the rest of the year.



THIS ISSUE'S CONTRIBUTORS: Carol Levin, David Lidsky, Sharon Nash, Sebastian Ruple.

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Subscription rates. The one-year rate (22 issues) is \$49.97 in the U.S., \$85.97 elsewhere. Make checks payable to PC Magazine; U.S. currency only.

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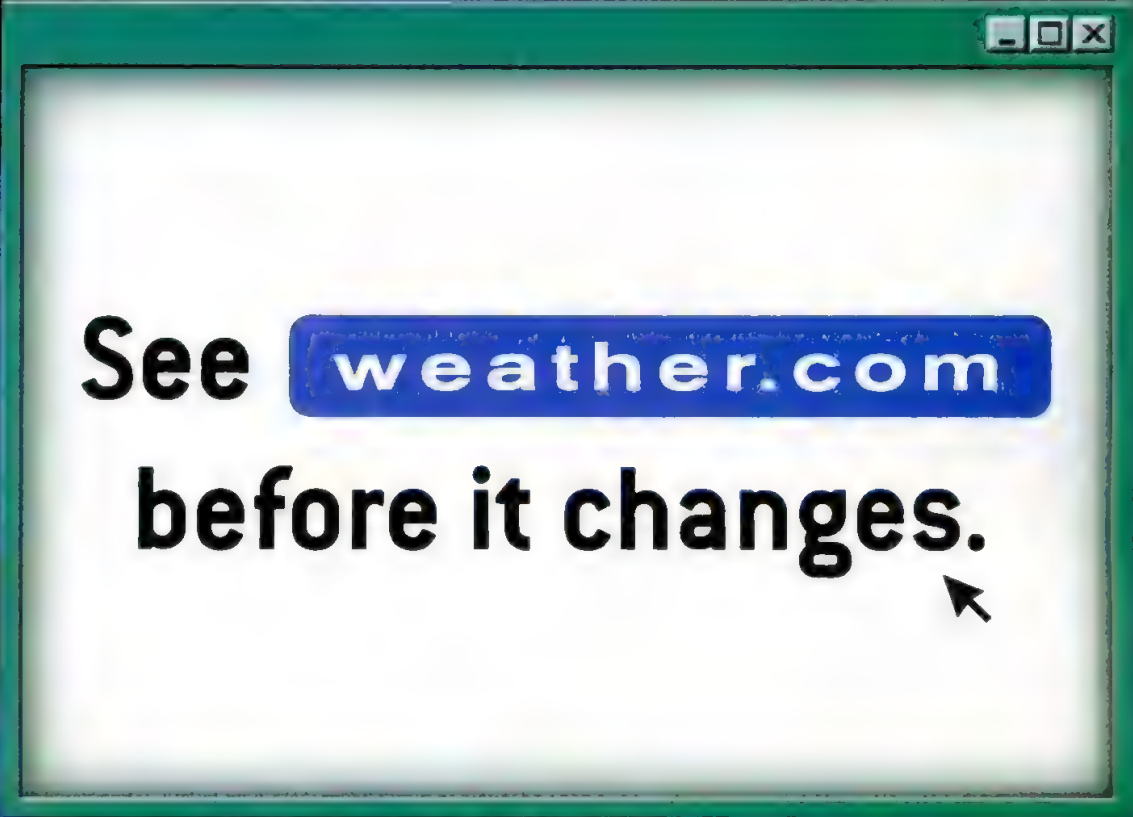


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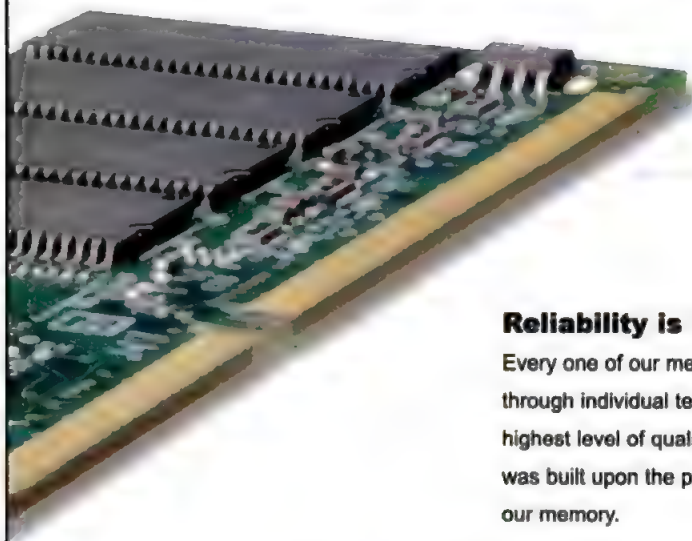
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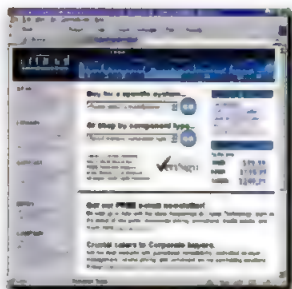
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Home MPC	\$151.98	NA
Powerstation P133 with 54Si BIOS	\$151.98	NA
ClientPro VXE 200/233	\$85.49	141.00
Magnum Pro Plus P200	\$151.98	NA

Gateway	Crucial	Kingston
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P5-133	\$157.68	247.00
GP6-300	\$82.64	141.00

IBM	Crucial	Kingston
Aptiva (2140) Model L5H	\$82.64	157.00
PC 300GL Series Pentium II Systems (6591)	\$82.64	157.00
PC 300PL (6892-50U)	\$85.49	154.00

HP	Crucial	Kingston
Pavilion 3260	\$82.64	141.00
BRIO Advanced Business Models 6330	\$82.64	141.00
Vectra VL Series 8	\$85.49	141.00

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LETTERS

OFFICE 2000

I read your cover article on Microsoft Office 2000 with interest ("Office 2000: Should You Upgrade?", May 25). But I thought that several important points were glossed over, and the Lotus and Corel packages were given short shrift. Although the Web-enabling features of MS Office 2000 are impressive, the requirements to take advantage of these features (major commitments of resources, restriction to a single browser, setting up an intranet based on Windows NT) are mentioned almost in passing, in a single sentence. And in the file compatibility section, you note that MS Office 2000 is backward-compatible with the previous iteration of Microsoft Office "with the notable exception of Access." In six words, you dismiss the grief this is causing companies that rely on applications developed in Access 2.0 on up but cannot afford to devote a developer to rewriting applications that often perform critical functions.

I find it interesting, too, that no mention was made of the VB-like macro language that makes it absurdly easy to write viruses, which subsequently affect only Microsoft Office and such tie-in applications as Outlook. I realize the issue probably went to press before it happened, but the Melissa virus demonstrated the vulnerability of Microsoft's products to security breaches, lost productivity, and extra administrative overhead. I would like to see cover stories on Corel and Lotus products, as well as on non-Windows applications. After all, there's already a Windows magazine.

PATRICIA LEEB-HART
San Francisco, California

Market share has never been one of the leading criteria in selecting products for evaluation at PC Magazine. We look for innovative and compelling products that meet the real needs of business and home users. But our ultimate goal is to serve readers. According to our latest survey—the subject of the story "Software Support and Satisfaction" in this issue—76 percent of PC Magazine readers use a version of

Microsoft Office (about 14 percent use Corel WordPerfect, and 4 percent use Lotus SmartSuite). The MS Office 2000 story was designed to reflect that reality while providing readers with details on new features in Corel WordPerfect Suite and Lotus SmartSuite, both of which remain important products.

File compatibility is a crucial issue, and the distinction between file compatibility and backward file compatibility is important. Solutions created in Access 97 or earlier versions will run in Access 2000, although Access 2000 users cannot make modifications to the design of tables, queries, forms, and reports. If you convert an existing solution to Access 2000, you can make modifications, but it will no longer be easily accessible by users of earlier versions: It is not backward-compatible, because Access 2000 changed the file format in order to support Unicode (which enables multinational companies to use data in different languages). Solutions created using Access 2000, however, can be converted manually to Access 97 format (Tools | Database Utilities | Convert | To Prior Access Database Version) as long as the solutions do not use the object model enhancements specific to Access 2000.

We discussed file compatibility in several other places. For example, we

The Melissa virus demonstrated the vulnerability of Microsoft's products.

ran a suite of tests to test file compatibility between the suites and when publishing files to HTML for viewing in both Internet Explorer 4.0 and Netscape Navigator 4.5 (see sidebar on page 128).

Finally, our story included a sidebar on other office suites, such as AppleWorks and Star Division's StarOffice, both available on non-Windows platforms. See First Looks in our June 8 issue for a review of StarOffice 5.0 Personal Edition and other office suites.—Ed.

A GOOD EMPLOYEE IS HARD TO FIND

Kudos for "Job Hunting and Hiring on the Web" (May 25). It correctly identifies many of the important features and benefits of online employment environments. A major piece of the employment puzzle was not covered, though. At any given time, there are tens of thousands of jobs that corporations do not advertise publicly, which include executive positions or those that require specialized skill sets, and some that require professional discretion. Missing from the article was how to access this "hidden" job market. To fill these positions,

corporations turn to the over 30,000 employment-search consulting firms in North America. Cumulatively, these firms account for an \$11 billion slice of the employment services market. As with their corporate counterparts, third-party recruiters are using the Internet aggressively, to the advantage of their clients and job seekers. Job seekers and corporations can access well-developed employment sites maintained by the following recruiting organizations: Recruiters OnLine Network (www.recruitersonline.com), dice.com (www.dice.com), Net-Temps (www.net-temps.com), and Top Echelon (www.topechelon.com).

GLENN WHITTEN
via the Internet

TRICKS OF THE TRADE

As a longtime user of Omega Research's TradeStation ("Trading like a Pro," First Looks, May 25), I have purchased the upgrade to TradeStation 2000 but have not yet installed it, for the following reasons: Users are reporting problems with usability, quirky and unreliable operation, and outright bugs. Con-

trary to the statement in your article, very few of these problems have been resolved yet.

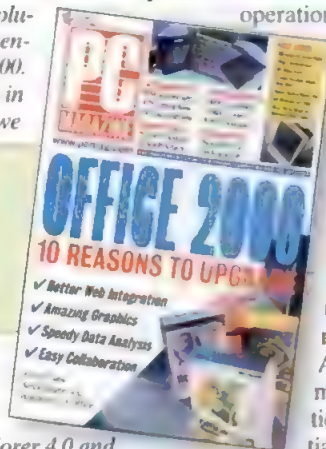
You mention inadequate documentation: This has been a longstanding problem with Omega's products, and this new, more complex product is delivered with greatly reduced documentation. Another problem is that terminology, menus, and functions have changed substantially in the new version, with no documentation of the changes to alert past users who are upgrading. I realize that this was a First Look, but even so, I think PC Magazine owes its subscribers a bit more care in considering and reporting serious quality issues.

CARROLL SLEMAKER
via the Internet

It's true that Omega Research hasn't yet resolved the instability issues. That said, we believe we hit all of the key points, given our limited time and space. This is a complex product, so people who exercise the advanced features more than we can in a First Look may find additional glitches beyond the instability issues we mentioned.—Ed.

THE WRONG KEY

On reading "IBM Thinks Ultrathin" (First Looks, May 25), I was astounded that you think the ThinkPad keyboard "replicates a standard desktop keyboard better than any



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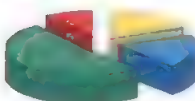
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Quarterly Report

Chart represents regional sales



Next Quarter Focus

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we've tested." The ThinkPad's keyboard shares a problem with many other laptop keyboards: The placement of the Ctrl key doesn't match its position on a desktop's keyboard. Standard keyboards place the Ctrl, Alt, and A keys in a tidy equilateral triangle. When changing from a desktop PC to a laptop, I despise finding a Fn key where the Ctrl key ought to be! If you really want to see the best laptop keyboard layout on the market, take a closer look at the Dell Inspiron on the inside back cover of your magazine.

PATRICK COLVIN
Jamul, California

COOL RUNNINGS

In reply to Bill Machrone's column "Run Fast, Run Cool" (May 25): I understand that it was not his intention to inform readers of how to overclock a processor; regardless, I believe that he made two important omissions. First, there is the issue of processor damage. An overclocker must use decent judgment; one certainly does not want to run a Pentium II/300 at 500 MHz.

Eventually, an overclocker may encounter the problem of *electromigration*: the process by which, over a period of time, the transistors are damaged by pushing the processor past its specs. Without a doubt, my processor will fail earlier if I overclock it than if I run it at the rated 350 MHz. According to Intel, its processors have rated lives of ten years. If I shorten my processor's life by half, it will still be obsolete before it fails, so this is a risk I knowingly take.

Second, Machrone talked about techniques for cooling a processor (overclocked or not), beginning with expensive Peltier Effect coolers and moving on to software programs such as Rain and Waterfall. But he failed to mention the simplest and cheapest method possible. I bought a tube of thermal compound at Radio Shack for about \$2. A thin layer of this compound between the processor and heat sink dropped the temperature of my processor by about 20 Fahrenheit degrees.

BRIAN R. IWASKEWYCZ
via the Internet

SELLERS, BEWARE

In his column "Y2K: Someone's Gotta Pay" (May 4), Jake Kirchner stated that "most vendors will be more likely to offer fixes if they have some protection from extensive liability." I can't understand why that would be true. Reducing the possible cost of *not* fixing a defective product will induce the vendor to fix it?

MIKE BARNES
via the Internet

Legislators believe companies will feel that offering to fix their products is tantamount to admitting the products are defective, an admis-

Corrections and Amplifications

In our story "Office 2000: Should You Upgrade?" (May 25), we incorrectly indicated that Microsoft Office 2000 Small Business Edition contains PowerPoint; it does not.

In our story "Color Network Printers" (May 25), we incorrectly stated that the Tektronix Phaser 840 supports legal-size media. It does not. We also published the wrong speed test results for the Phaser 840, whose scores were actually much faster: The printer posted print speeds ranging from 5.9 to 10.8 ppm on our Microsoft Word tests. For complete results, see the benchmark test chart on our Web site, at www.zdnet.com/pcmag/stories/reviews/0,6755,399897-3,00.html.

In our review of the Intel InBusiness Print Station (Networking First Looks, May 25), the cost of the unit was wrongly listed as \$399; the correct price is \$219. In addition, we reported that the unit supported NetBEUI, TCP/IP, and IPX protocols. You can share the unit on an IPX network with a Windows NT server, but the unit itself does not support IPX.

In our story "Read the Fine Print" (After Hours, May 25), we listed the URL for Oriland: The Paper's World incorrectly. The correct URL is www.origami.aanet.ru/.

sion that they would rather not make unless they have some protection against lawsuits that might be based on or supported by those admissions.—Jake Kirchner

COUNTRY LIFE

I only wish that my local ISPs were doomed to extinction and that my local phone company would give me DSL or my local cable company would give me cable Internet service ("ISPs: Doomed to Extinction?", Bill Machrone, May 4). Unfortunately, I live in a rural area where neither service is likely to be available anytime soon. The irony is that the advent of high-speed data communications is the main factor that enabled me to escape the city and live here without sacrificing my high-tech careers as a database programmer, Web programmer, and writer.

The phone companies tell me I have to be no more than 15,000 feet from the switch to get DSL (I live 10 miles outside of town), and the cable companies tell me they will never offer service where I live. As for T1 or fractional T1, the nearest switch is 15 miles away. I didn't even ask what that would cost.

And no, I do not want to get an office in town just to get decent phone service! I like being able to check my e-mail while I eat dinner or take a break in the middle of the afternoon and go out and rub noses with the llamas. So until the phone companies wake up to the reality that there are a lot of technically savvy people living in rural areas, we can't complain too loudly about our local ISPs. They are still our lifeline.

MIRIAM LISKIN
via the Internet

A PRO ETYMOLOGIST

In the Letters column (May 4), a reader requested the definition of the word *prosumer*, used in "Shoot like the Pros" (First Looks, February 9). The answer given is incomplete. The term *prosumer* was coined by Alvin Toffler and first appears in the book *The Third Wave*. Toffler defined a *prosumer* as a person who produces what he or she consumes, or at least provides input into the production of a product. Toffler envisioned a process whereby

a customer can access a service and punch in specifications. The service then fabricates a custom product and ships it to the prosumer immediately.

MIKE MAAG
via the Internet

WATCH FOR FLYING ZIP DISKS!

You might get a kick out of this! When my external Zip Drive died, I shipped it to Iomega for repair. Iomega quickly sent me a different one that was fully operational. But the new model has an added feature: When my system shuts down and the drive ejects the cartridge, it shoots out about 2 or 3 feet. If you happen to be sitting in front of the drive (positioned on top of my tower under the desk), it clocks you on the shin. And that hurts! I can't think of a better way of getting back at someone who uses my system without asking.

JESSE PARRIS
via the Internet

PC Magazine and Beyond



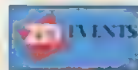
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Toshiba's Small Door a Big Help

Opening on side makes servicing Equium® easy

BY MICHAEL CATON, PC WEEK LABS

THE SIDE DOOR ON THE EQUIUM 7000S desktop PC is one of those small features that works so well that it's a wonder no vendor thought to include one like it before.

The side door on Toshiba America Information Systems Inc.'s \$1,714 computer is designed to make



The Equium 7000S allows easy inside access.

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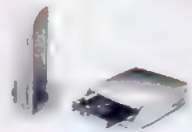


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Year 2000 Compliant	NSTL hardware tested
Wireless Management (WIM) Compliant	Yes
Software Help, Toshiba Configuration Builder, SMS Connect	Intel LANDesk Client Manager, Expert Intelligence Help, Toshiba Configuration Builder, SMS Connect
Processor CPU	Intel Pentium® III processor, 450MHz or 500MHz (with 512KB cache) Intel Pentium II Processor, 350MHz, 400MHz or 450MHz (with 512KB cache) Intel Celeron™ processor, 333MHz, 366MHz, 400MHz or 433MHz (with 128KB cache)
Memory Maximum	32MB, 64MB, 128MB or 256MB SDRAM 512MB
Bus Speed	Matched with CPU Bus Speed

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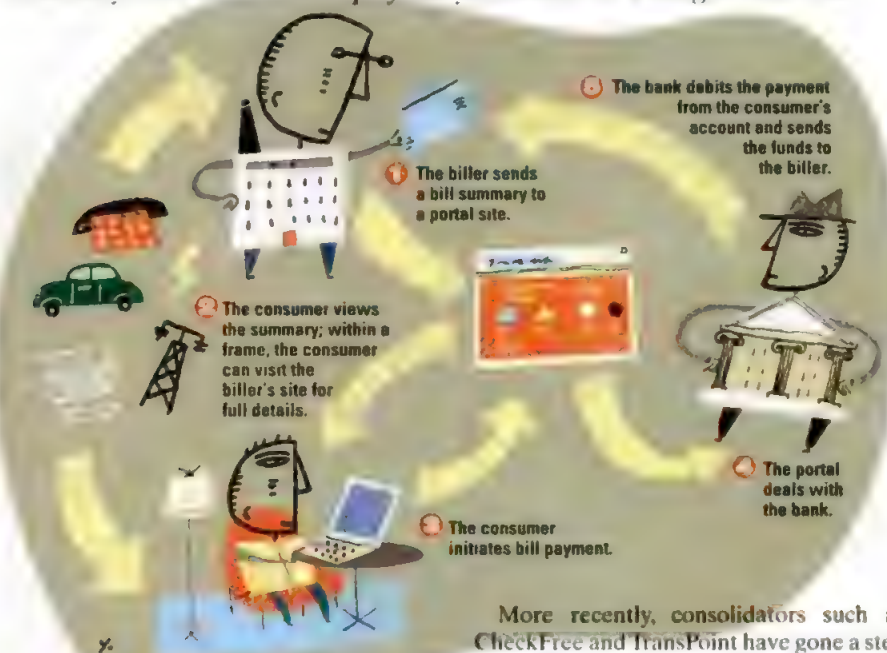
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Paperless Bills

You may soon be able to pay all your bills at a single Web site.



The American consumer is flooded with bills almost every day: bills for utilities, bills for credit cards, bills for medical expenses. The paper trail of bills, checks, and receipts is confusing at best, but the Internet is offering a solution: electronic bill presentment and payment.

Bill consolidator CheckFree has several years' head start over Microsoft-backed TransPoint and is the current favorite. Meanwhile, the Sun Microsystems/Netscape Alliance also has big plans for online bill payment. Most people, however, still prefer to pay by paper check and snail mail.

Traditionally, billers such as utilities and credit card companies send paper bills. Customers then mail checks to billers, and billers deal with banks to debit accounts. For several years, online bill payment has been available through Microsoft Money's and Quicken's online options, as well as through an increasing number of banks such as Chase and Citibank. This process saves you the trouble of writing and mailing checks, but paper checks are still produced and mailed to billers.

More recently, consolidators such as CheckFree and TransPoint have gone a step farther, providing bill aggregation and Web presentation technology to billers. Customers visit billers' (or consolidators') Web sites directly, enter bank information, and arrange for electronic checks or direct debits. "Bill payment has been available for several years, but bill presentment is the final piece of the puzzle," says Gustavo Machado, a spokesperson for CheckFree. "Presentment will make this a paperless process." Currently, only two banks—Bank One and First Union—present bills to customers using CheckFree as the processor, says Machado.

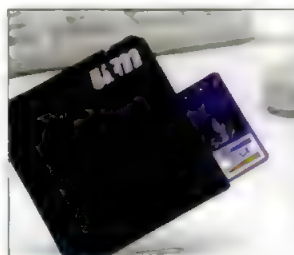
With a rumored partnership between CheckFree and Yahoo! in the works, an even simpler approach may be available in which consumers will be able to visit a single portal or bank site and review a summary of all of their bills, which a consolidator has provided. Consumers can then visit billers' Web sites via a frame in the portal. The benefits? Consumers need to visit only one site, portals and

billers get eyeballs and customer loyalty, and consolidators get a piece of every transaction.

"For the moment, a direct distribution model suits everybody. It provides sticky content that will bring customers back time and again," says Avivah Litan, a director for market research firm GartnerGroup. Nevertheless, she predicts some dramatic changes. "Portals will eventually get in on the action, get rid of consolidators like CheckFree and TransPoint, and go directly to the billers themselves," she says. She goes even further to suggest that within five years consumers will have electronic agents sent out from household devices that will handle such chores as bill payment automatically, eliminating the need for Web portals as we understand them today.

When it comes to purchasing goods online, electronic payment methods are multiplying at breakneck speed. Dozens of electronic wallets are available, as are keyboard-based credit card readers and even cellular phones with credit card swipes. Some analysts say consumers aren't quite ready to embrace alternative methods of bill payment, such as electronic cash or smart cards. "In the next five years, a lot of households will be banking online and receiving and paying bills online. There will be lots of different ways to pay, but credit cards will be dominant for online shopping," says Rob Sterling, an analyst at Jupiter Communications. "We still don't have a truly fluid way to move money on the Web," he says.

Start-up UTM Systems has come up with a solution: the UTM Machine, a standard floppy disk reengineered as a magnetic-stripe reader with a slot for a credit card. To make a Web purchase, you slide your credit, debit, or ATM card into the disk and insert it in your PC's floppy disk drive. An ATM-like interface pops up on-screen, and you enter your PIN via your keyboard. Since the system is linked to the ATM network, it's able to verify your PIN just as an ATM does.



KA-CHING: The UTM Machine is a reengineered floppy disk that reads a credit card's magnetic stripe for Web purchases.

The UTM Machine eliminates the need to reenter payment information whenever you make purchases. And the rather low-tech approach doesn't require you to get a special smart card. The mag stripe readers will be available for free from banks.—Sharon Nash





Big, Bright Panels

Computer displays have remained more or less the same for the past dozen years, but it's likely that in two or three years, you'll be using monitors that are substantially different. At the recent Society for Information Display conference, developers showcased some emerging technologies for making improved microdisplays, LCDs, plasma displays, and CRTs.

On the LCD front, companies are investing in ways to increase yields, yet analysts expect prices to be higher in the short term. Research firm Stanford Resources predicts the dollar value of LCD monitors will surpass that of traditional CRTs by 2001 or 2002.

CRTs aren't standing still, however. Products have appeared with wider deflection (which makes cases smaller), narrower yokes, and flat-faced tubes. These innovations require other changes, such as laminated plastic coatings and tempered glass to reduce the chances of CRT implosion. Dai Nippon Printing reported on a new technique for creating aperture grills and shadow masks at about half the size of existing designs, which will make much higher resolutions possible.

Microdisplays—panels under 1 inch diagonally—were also hot news. Displaytech has formed partnerships with Hewlett-Packard in the U.S. and Miyota in Japan. Displaytech intends to fill an order for 50,000 of its quarter-VGA color displays by September, which will be used in consumer products available at the end of this year. And Daewoo Electronics discussed development of a micromirror chip that will compete with the Texas Instruments digital micromirror device design.

Plasma display panels are bigger and brighter, and they have better contrast than ever before. Plasmaco demonstrated a 60-inch-diagonal display (above). And Fujitsu reported on a new addressing technology that doubles resolution with the same number of electrodes as existing designs, while producing faster response times and brighter images.—*Alfred Poor*



Surfing Your Day Away



Our first-ever Internet Service Provider Support and Satisfaction Survey focused on how satisfied our readers are with the ISPs they choose. But at PC Magazine Labs, you can't stick nearly 8,000 responses and over a quarter of a million data points in front of us without making us drool a little bit. We see that much data and want to mine it, to find out every last bit of information hidden inside.

Our story focuses on satisfaction by vendor, but we also gained tremendous insight into how people use the Internet. So armed with our trusty copy of Microsoft Office 2000, we donned our mining helmets, imported the

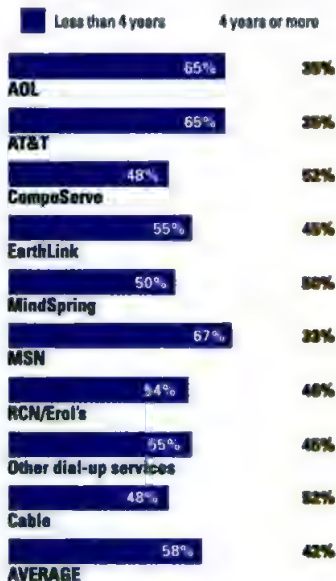
ber increases fairly linearly. Almost half of the users who've been on the Net for four or more years are using it an hour a day.

■ The prior two points might lead you to believe that CompuServe has the most novice users, but actually the service's members are the most senior. Over 50 percent of CompuServe members have been on the Internet for more than four years. The aggregated cable users have similar online experience. Three of the largest ISPs—AOL, AT&T, and MSN—have the most junior memberships. Only about a third of their users have more than three years online, indicating that they're attracting many Net newbies.

■ Quality and uniqueness of content certainly seem to build loyalty, perhaps even more than quality of service. More AOL and CompuServe users start there and stay there; 58 percent and 68 percent, respectively, report having had only one ISP in their years on the Internet. With other ISPs, only 38 percent of users say they've had only one ISP. On the other hand, this could indicate that users are more likely to switch away from AOL and CompuServe than to switch to them.

■ Most ISPs want to be your portal to the

USERS' WEB EXPERIENCE



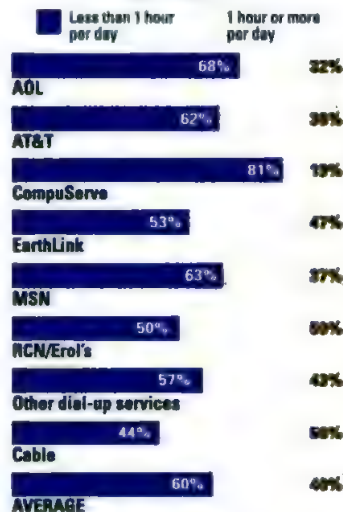
data into Access, ran some queries, dumped the data into Excel, and used the new version's vastly easier Pivot Table feature and new Pivot Charts function to explore.

Here's what we found:

■ Less than 20 percent of CompuServe users spend an hour or more per day online. AOL has the second-lowest number of such users (32 percent). 43 percent of users of other dial-up services and more than half of users with cable modems and other high-speed connections spend an hour or more online each day.

■ The longer you've been on the Internet the more you use it. Only about a quarter of those in their first year online are using the Internet more than an hour a day. That num-

TIME USERS SPEND ONLINE (BY ISP)



Internet so they can generate additional revenue from you, but they're not having a whole lot of success. Across all services, only 30 percent of respondents' home pages are their ISPs' Web sites. Only MSN and Prodigy have more than 50 percent retention. CompuServe brings up the rear, with just 21 percent.—*Ben Z. Gottesman*

RESEARCH

Quantum Dots

When Moore's Law—which states that chip density will double every 18 months—reaches its limit and chips can't get any smaller, what happens then?

As reported recently in *Science*, researchers at the University of Notre Dame are working on a method for building circuits—called quantum-dot cellular automata—that need only a tiny initial electrical charge to transfer information. In a domino-like effect, the charge of the first cell in the circuit charges all the cells that follow. This could result in the development of tiny, powerful computers that

run for extended periods of time on small batteries instead of relying on large and constant sources of electricity.

Quantum dots are little islands of metal that can capture electrons. Because of electrostatic repulsion, electrons can position themselves across one diagonal or another. Each diagonal corresponds to a binary 0 or 1. When

information can thus be transferred without any electrical current coaxing it along. The Notre Dame researchers put the theory into practice recently by creating a simple digital logic gate—a fundamental building block for microprocessors—using quantum dots.

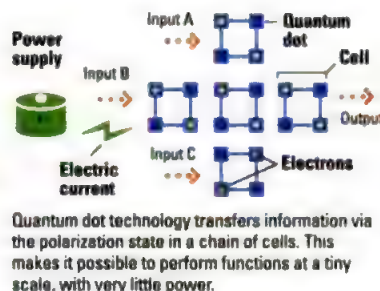
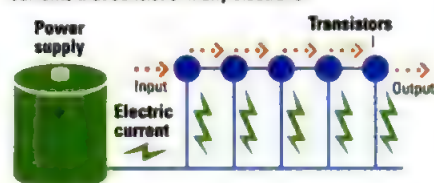
"Moore's Law will eventually run its course, and computer miniaturization as we

know it may need to be replaced by something new," says Islamshah Amlani, a member of the Notre Dame research group. "These new methods may provide an answer, as quantum dots can theoretically be shrunk down to the molecular size. These minuscule devices will save

tremendous amounts of power, with potentially 1,000 times less power dissipation than current devices." —Sharon Nash

Quantum Leap

Today's computers transfer information via currents that consist of many electrons.



organized in a line, these cells can transmit information by polarizing only the first cell, which then polarizes all the other cells. Infor-

Near-Perfect Technologies

Our annual Perfect PC issue is a big project, requiring more than six months of work. In the process, we get rather caught up in thinking about perfection and what it means in terms of personal computing technologies and products.

If you read my last column you know that I tend to think technologies and products can't be considered perfect unless they work flawlessly. That would seem to put me at odds with our cover story, but I'm practical enough to know that you have to make do with what you have. We couldn't very well fit "The Best PC for You Depending on Your Circumstances and Making Allowances for the Less-than-Perfect State of Personal Computing Technologies Today" on the cover.

Even so, my previous column's complaints about the imperfect products that tantalize us with their promises but disappoint us in their implementations led several folks to accuse me of being overly critical. *Cumudgeonly* was a word that came up several times, as they asked, "Don't you like anything?"

In response I say, "You bet."

Take for instance my new 3Com Palm V. This little guy is a real joy. It's light and easy to use, and it works as advertised in every way. And its value is compounded greatly by the nifty new version of Lotus's EasySync for Notes, which makes it possible for me to use the Palm with my Lotus Organizer PIM and our corporate e-mail system.

The Palm V comes just in time to help me take advantage of another wonderful technological advance at *PC Magazine*: our virtual private network (VPN), which lets me tunnel through the Internet to access our corporate

Notes databases from my desktop at home. I access it through my new cable modem, which has finally made the Web-at-home promise a reality.

By relying on my 4-ounce Palm V to contain all my PIM data and the VPN to provide e-mail access from home, I no longer have to lug my laptop home with me every night just to stay connected to the office. No knock on that laptop, however: It's an IBM ThinkPad 600E, which lives up to its stellar reputation. I'm using it to write this column while aboard a plane to L.A. And I'm listening to a collection of MP3 tunes on a CD spinning in the notebook's DVD drive and playing through the newest version of MusicMatch's very impressive JukeBox software.

Speaking of e-mail, now *there's* an example of a technology that just works. Today there is not one friend, business acquaintance, or family member, including my parents with their WebTV, whom I can't reach via e-mail. E-mail is everywhere. For instance, my new cell phone's digital PCS service from AT&T offers e-mail, as well as voice mail, paging, Caller ID, Call Waiting, calendar, note pad, and games. The phone itself, a Nokia 6160, is a marvel.

On the office front, I am really impressed with the installation and operation of the Matrox Marvel G200-TV system. I dropped the video card in, plugged in a few cables, put the software CD into the DVD drive, and hit Enter a couple times. In minutes I was getting the midday CNNfn business news update in a window on my monitor. Very neat.

I could go on, but we're about to land. So the bottom line is that we're already surrounded by a lot of technologies and products that are worth admiring. They're not all perfect, but I won't complain if you won't.



Jake Kirchner

GO NAKED

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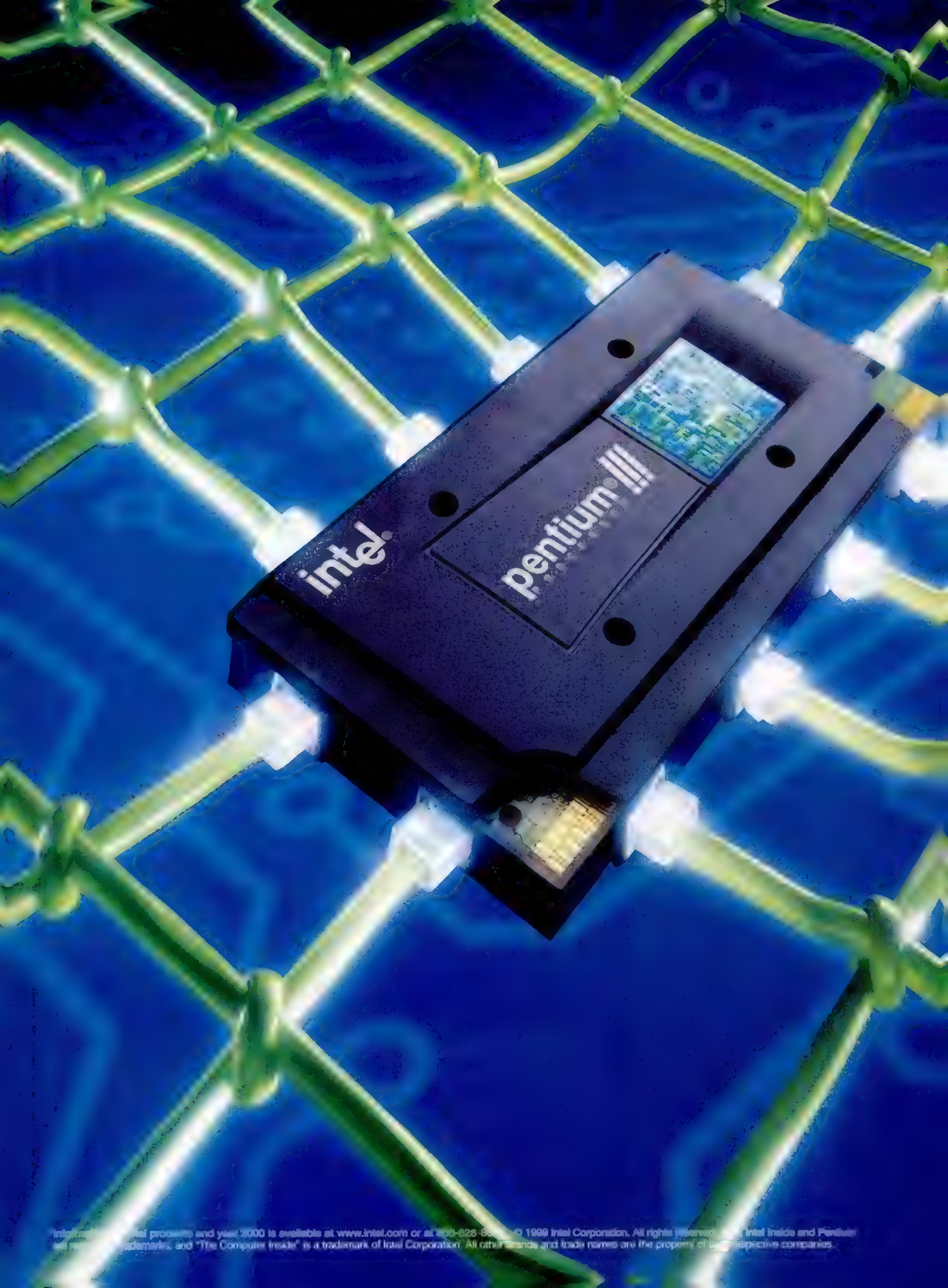
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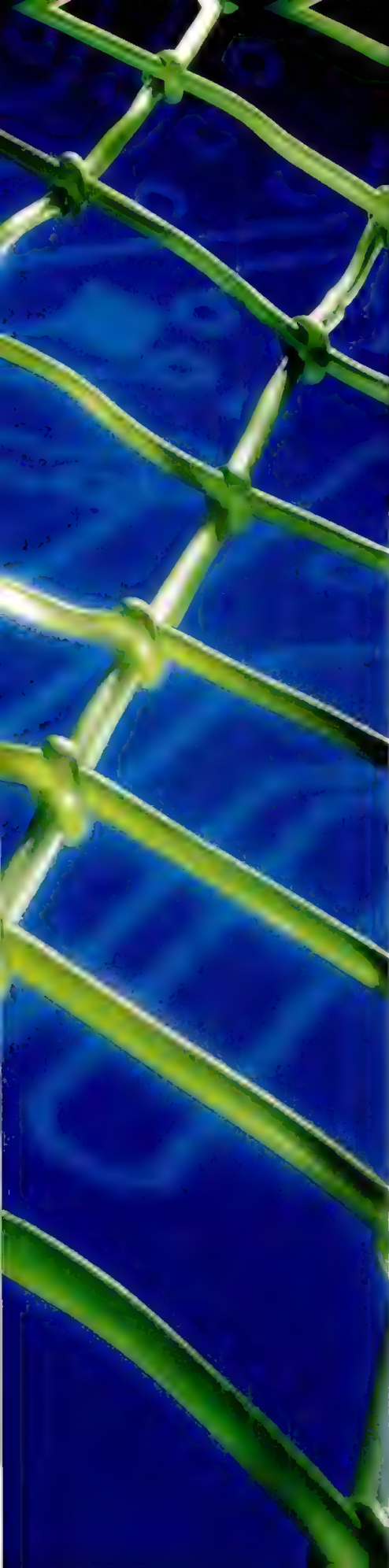


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E-COMMERCE

Shopping Bots

Shopping bots are like Santa's little search engines. Type in the name of a product and these binary buyers scour the Web, looking for bargains. In theory, these are wonderful tools, finding the cheapest books, videos, computer games, sound cards, or even cigars and home fitness equipment in cyberspace. In practice, however, not all bots are so hot. The best deals often go un-found, and searches lack the sort of precision savvy surfers now demand. Like most of the Web's new technologies, shopping agents are works in progress, destined to be better tomorrow than they are today. But some already lead the pack. Here's how they stack up.

Bottomdollar.com (www.bottomdollar.com)

Like most bots, Bottomdollar.com lets you pick a category and search from there. The bot searches all of the major merchants for each category and lets you sort results by price. You can limit book searches to paperback, hardcover, or audio titles; music searches to cassettes or CDs; and video searches to VHS, DVD, or laserdisk—a nice touch. Links to products often took us to merchants' home pages and not to the products themselves. And prices were sometimes inaccurate. A video listed as \$19.98 at Reel.com actually sold for \$18.99, and a CD listed as \$17.98 at CDnow really sold for \$17.99. When we searched for a 3Com Palm IIIx under the Office Products category, the best price returned was \$339.61 (from Tech-Store). When we looked under Computer Hardware, the bot queried many more vendors and found a cheaper price: \$311.74 (from PC Mall). But Bottomdollar.com's queries were frequently unsuccessful, returning empty-handed from merchants. The result: The best deals often went undiscovered.

Excite shopping (www.excite.com/shopping)

Excite's Product Finder covers a limited number of categories. Unlike other bots, it doesn't look for books and music. But for other categories, Product Finder makes searching easy. Categories such as computer hardware are broken down into useful sub-categories (such as monitors, laptops, desktops, and PDAs). You can search for products or reviews—a convenient feature. Advertis-

ers do get preferential treatment. For books and music, Excite has entered into exclusive partnerships (with Amazon.com and CDnow, respectively). These goods aren't available through Product Finder. To look for a book, click on the link at Excite's shopping channel: You'll be taken to a search engine that searches only Amazon.com. The music channel searches only CDnow. But for the categories it does cover, Product Finder searches multiple sites (nine for tea vendors alone). Results can be sorted by price, and hardware searches can be quite specific. For the product types it searches, Product Finder found some good deals (such as a \$279.95 Palm IIIx—matched only by mySimon). But for the best bargain prices on books or CDs, look elsewhere.



mySimon (www.mysimon.com)

This is the bot to beat. MySimon queried so many sites (over 1,000, according to mySimon—15 for tea alone) that it did a better job of finding the best deals than the other shopping agents. It offers dozen of categories, which cover just about any item you're likely to buy on the Web. You can also search auction sites (such as eBay) and classified ads. All major merchants are searched, and advertisers are denoted by their logos. You can sort results by price, and you can limit book searches not only to hardcover or paperback but also to new or used titles. MySimon also lets you search for vinyl versions of albums—a feature

no other bot offered. But there is room for improvement: Searching by title and director for the James Cameron film *Titanic* yielded a non-Cameron documentary. And the site returned a best price of \$15.60 for the book *The City of War* at All Direct, missing the \$14.40 price at BuyBooks.

WebMarket (www.webmarket.com)

WebMarket covers specific categories of products—such as books, consumer electronics, and office supplies—but within these categories, you're limited to specific types of goods. For example, the Computer Hardware category lets you look for modems and printers but not PDAs. The Consumer Electronics category lets you search for VCRs and stereos but not PDAs. And many top online merchants are missing. The books bot, for example, listed no results from Buy.com. Searching is basic. Strangely, the more information you enter the less accurate the results often are.

For example, when we entered the title of an album (*Bury the Hatcher*), WebMarket returned a low price of \$12.99 at Pentagon.net. When we entered the same title along with its artist (The Cranberries), the bot returned a low price of \$13.77 at CDworld. You can't sort by price, and the bot often misses the lowest price, because the searches can be inaccurate. For example, a search for the game *Half-Life* returned links to Lotus Notes and Mortal Kombat 3.

Yahoo! Shopping (shopping.yahoo.com)

This bot searches Yahoo! merchants (those vendors that sell through the portal) first. Only when this search has been completed can you choose to search other Web-based merchants—an annoying extra step. Not all the news is bad, though: When you enter keywords, Yahoo! scans its database and lists all items that fit the description. You click on the best match and the bot searches for only that product, eliminating irrelevant hits. Yahoo! also searches auctions, but only its own. Search criteria are limited. You can enter keywords but can't specify a hardcover or paperback book or the format of a video or music album. Yahoo! does a decent job of finding bargains—comparable even to mySimon. But it's a cumbersome process, as the first-round Yahoo! merchants often don't offer the best prices. Only by performing a second search, on other Web-based vendors, will Yahoo! Shopping actually find the best deal.—Alan Cohen

Law and the Workplace



By Alan Cohen

Stock options aren't the only thing booming in today's workplace. Litigation is on the rise too. Citing discrimination, sexual harassment, and noncompliance with disability laws, employees are taking their bosses to court in record numbers. Ignorance of the law is no excuse, but understanding the key statutes can be a tricky business. When it comes to interpreting the law, even courts can disagree. The following sites do a good job explaining the dos and don'ts, helping employers keep clear of trouble and aggrieved employees right a wrong.

Avoid Discrimination

➤ Federal and state laws prohibit employment discrimination based on race, religion, sex, national origin, disability, or age. Unfortunately, the statutes tend to be written in legalese. **DiscriminationAttorney.com** (www.discriminationattorney.com), a site run by a Los Angeles-based attorney named David H. Greenberg, explains in clear, concise language the various types of discrimination and the boundaries of current laws. No federal statute, for example, prohibits discrimination based on sexual orientation. The banner ads aren't too subtle, but there is plenty of useful information. One section explains how an employer can avoid pregnancy discrimination; another advises potential plaintiffs what they need to prove to make their cases.

The **U.S. Equal Employment Opportunity Commission** is the agency charged with enforcing the federal statutes. The agency's site (www.eeoc.gov) may be short on pizzazz, but it is long on substance. Fact sheets on age, race, religious, and sex discrimination help both employees and employers understand the legal framework. There's information on how and when to file a charge with the agency, as well as addresses and telephone numbers. But be prepared to wait: The agency handles over 80,000 claims a year.

Stop Sexual Harassment

➤ Sometimes employers can get in legal hot water by doing nothing at all. Case in point: sexual harassment. According to the law, employers can be held liable if they knew or should have known about the offending behavior but failed to take appropriate measures. This is just one bit of useful information found at the Alexander Hamilton Institute's **Employment Law Resource Center** (www.ahipubs.com). The site is geared toward selling newsletters and manuals, but the free

FAQs can be invaluable to employers looking to avoid sexual harassment suits. At **LawGuru.com**, a section on harassment (www.lawguru.com/sexhara.html) notes the benefits of creating a firmwide sexual harassment policy. It also covers the responsibilities of the employer once a complaint has been lodged, stressing the importance of immediate and effective action.

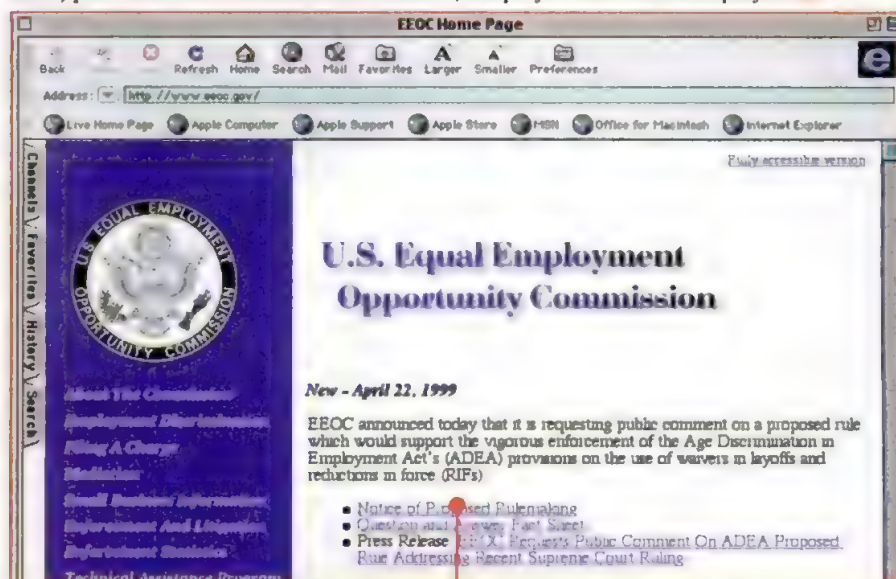
Even the most thorough preventive measures don't guarantee a harassment-free workplace. For employees who believe they've been victimized, the Feminist Majority Foundation's **Sexual Harassment Hotline Resource List** (www.feminist.org/911/harass.html) provides contact information for local

against persons with disabilities, not just in employment but in public accommodations too. This means that businesses such as restaurants, theaters, and stores need to take steps (including new construction) to make their services accessible to all. The **Department of Justice ADA Home Page** (www.usdoj.gov/crt/ada/adahom1.htm) can help, offering guidance and examples in plain English.

The ADA is also covered in the **Disability Etiquette Handbook** (www.ci.sat.tx.us/planning/handbook). This site is a terrific resource, including tips on how to conduct and schedule interviews with disabled applicants. For example, a person in a wheelchair will often have to arrange transportation in advance, so an employer should tell the applicant how long an interview will last.

Classify Correctly

➤ One way to avoid employment discrimination suits is to have no employees. Using independent contractors can reduce a company's legal exposure and payroll taxes. But companies need to be careful; classifying a worker as an employee or an independent contractor can sometimes be a tough call, and the tax penalty can be severe. Nolo Press's **FAQ for Firms Hiring Independent Contractors** (www.nolo.com/ic/faqhire.html) lays out the IRS's 20-factor test for determining when an employee is indeed an employee. **PC**



and national groups that offer counseling, support, and legal referral.

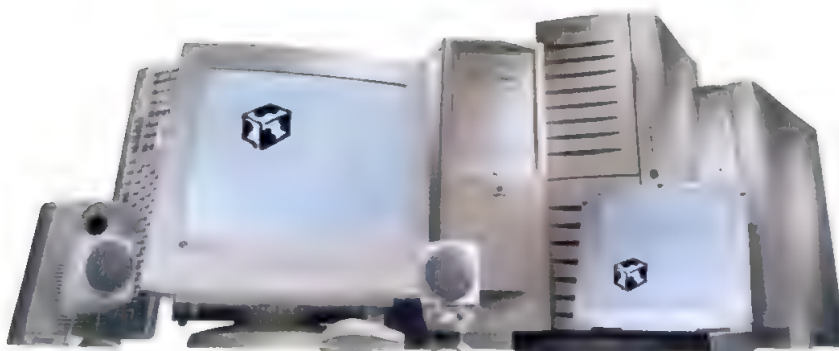
Deal with Disabilities

➤ Passed in 1990, the Americans with Disabilities Act (ADA) prohibits discrimination

The U.S. Equal Employment Opportunity Commission's site contains guidelines and a wealth of information on employment discrimination to help keep businesses out of legal hot water.

38%

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- 16MB NVIDIA RIVA TNT AGP Graphics
- 13.5GB Ultra ATA 66 7200 RPM Hard Drive
- 6X DVD-ROM Drive & MPEG2 Decoder
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- Boston Acoustics BA735 Digital Speakers w/ Subwoofer

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- 17X min/40X max CD-ROM Drive
- 10/100 Twisted Pair Ethernet
- Iomega Internal ZIP Drive
- EV700 17" Color Monitor (15.9" viewable)
- Business Audio with Speakers
- MS® Office 2000 Small Business Software
- Microsoft Windows 95 or Windows 98

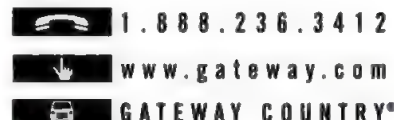
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Win2000: A Worthy Beta

For servers, high-end standalone PCs, and corporate network clients, Windows 2000 is shaping up to be a great solution.

By Steve Rigney

Many of us have come to expect a beta release of a Microsoft operating system to have more changes and new features than a complete version upgrade to a shipping product from other vendors. The new Windows 2000 Beta 3 (\$59.95 direct) meets that expectation and then some. In fact, if you consider that this beta is being sent to more than 650,000 users and is available to anyone via Microsoft's Corporate Preview Program, this release looks more like a shipping product than like code still in development.

In this review, we'll look at what's new in Beta 3 and whether individuals, small-office/home-office users, and corporations should consider it for testing or actual deployment. Beside the obvious bug fixes, the most exciting new features and improvements in Beta 3 fall within the areas of installation, configuration, ease of use, reliability, security, and troubleshooting.

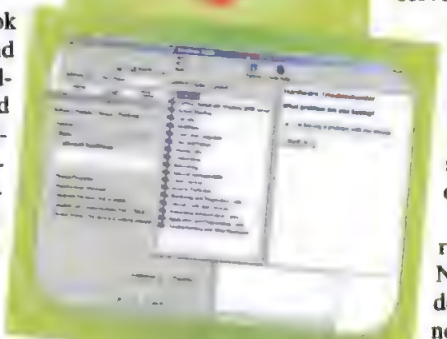
Generally, Microsoft is trying to use Windows 2000 as a multipurpose tool. It must simultaneously level Novell's high-ground advantage in directory services while shoving Sun Microsystems out of data centers by delivering high reliability and affordability.

Furthermore, Windows 2000 has to fight off the ankle-chewing efforts of Linux with attractive flexibility and tiers of pricing. No

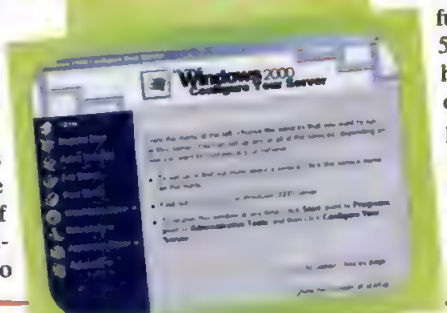
To relieve desktop clutter, Beta 3 has the Administrative Tools, Scheduled Tasks, and Network and Dial-up Connections icons on the Control Panel.



The new Troubleshoot button helps you diagnose a hardware problem straight from the applet in the Control Panel.



The Configure Your Server wizard lets administrators install only the components they need for a particular task, such as file or printer sharing.



multipurpose tool is perfect, but there is a lot to like in Windows 2000.

WHAT IS WINDOWS 2000?

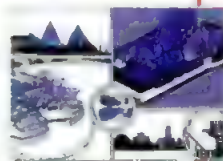
There is a lot of confusion about Windows 2000 and what it's supposed to replace. For years, we were calling it Windows NT 5.0, but then Microsoft changed the product's name.

We now know that Windows 2000 is a replacement for Windows NT, and that like Windows NT, it is designed for high-end standalone PCs, corporate network clients, and servers. The Windows 2000 family consists of the Professional, Server, Advanced Server, and Datacenter versions. Windows 9x is not going away and is still considered the best option for consumers.

Professional is a direct replacement for Windows NT 4.0 Workstation and is designed for standalone or network client PCs. It has most of the basic features but a limited Web server, and it supports up to two CPUs. Server has all of the features of Professional; it also works with two CPUs and adds an Active Directory controller and a full version of Microsoft IIS 5.0. Advanced Server can handle up to four CPUs, address 64GB of RAM, and provide load balancing and clustering. Datacenter's unique feature is its ability to handle 16 CPUs, and it supports more advanced clustering.

QUICK ON THE DRAW:

With AutoCAD 2000, Autodesk improves on the world standard for high-end computer drafting. *Page 49.*



MULTIFUNCTION DEVICES:

Save space and time with the Compaq A900 All-In-One and HP OfficeJet R60. *Page 66.*



LAN AS PBX:

3Com's NBX 100 Communications System lets you use your Ethernet network for PBX duties. *Page 76.*



More Products Reviewed

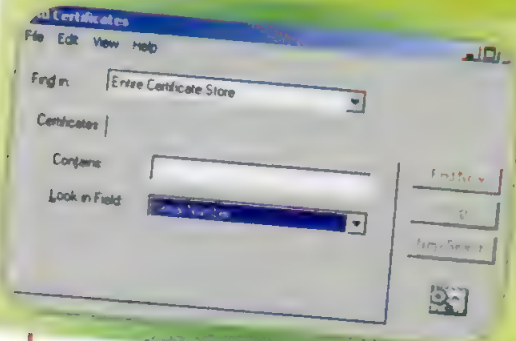
IBM ThinkPad 240	44
Brother MP-21C Mobile Color Ink Jet Printer	48
Microsoft Office 2000 Small Business Tools	48
eStore Builder for Drumbeat 2000	53
Canoma	53
Netscape Communicator 4.6	56
Opera 3.60	56
ELetter	57
CorelDraw 9	60
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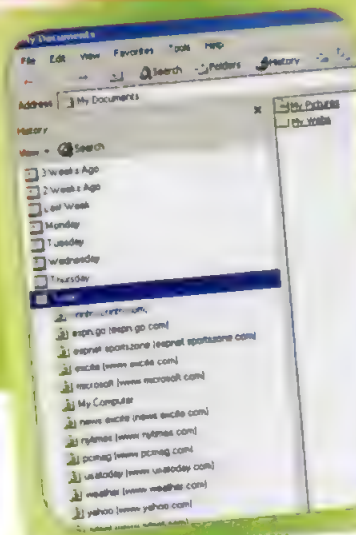
- Dazzle Digital Video Creator Internet Edition
- FrontPage 2000
- Gold Rush! 1.0

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The **Certificate Manager** lets you search for any available security certificates based on certain criteria, such as the serial number.



A **History folder** of visited Web sites is available in Windows as well as in Internet Explorer.

INSTALLATION

We found Beta 3 fairly easy to install from scratch or as an upgrade. To test the setup, we installed Beta 3 on a PC with no OS, on one with Windows 95, on one with Windows 98, and on another with Windows NT 4.0. All of the upgrades worked well, and with the new plug-and-play capability in Windows 2000, the OS was able to recognize all of our hardware devices.

For network administrators, the best new installation feature is the ability to install remotely. Administrators can create a boot disk that will start client PCs, point them to an existing Windows 2000 server, and automatically install the OS without any user intervention. This feature also works with bootable network adapters.

WHAT YOU'LL SEE

The changes to the user interface in Beta 3 are subtle but important. Basically, the GUI has been improved to eliminate a lot of clutter on the desktop. For example, the Channel bar that first appeared in Windows 98 has been removed, as have the icons for the various online services, such as AOL and CompuServe.

A change that might cause experienced Windows NT users to do some searching is the relocation of the Printers, Scheduled Tasks, Network Connections, and Administrative Tools from the My Computer folder on the desktop to the Control Panel. Novice users will appre-

ciate the new balloon help tips that pop up when you let your pointer hover over an icon.

Other user changes in Beta 3 include a combined History bar for Internet Explorer and Windows Explorer. Now any page you surf to in IE will show up on the History bar in Windows Explorer, and likewise, any file or directory you browse in Windows Explorer will show up on the IE History list.

CONFIGURING YOUR SERVER

One of the major problems with Windows NT 4.0 is deciding which services you need to install to create a networked service, such as a Web, file and print, or domain controller. Most administrators are too scared to remove software and services that they don't fully understand.

The new "Configure Your Server" wizard is a good step toward solving this problem. With this wizard, you can simply select file and print or Web services, for example, and the utility will install only the files and services you need. Although this still doesn't explain exactly what a particular service is doing, it does help you focus in on the services you really need.

RELIABILITY AND SECURITY

As businesses tried replacing their high-end Unix intranets, applications, and file and print servers with Windows NT, reliability became a sore spot with Microsoft users, many of whom

complained about the "blue screen of death" appearing at the most inopportune times on mission-critical servers. Likewise, dozens of bug reports were issued on the security holes in Windows NT. It will take months to see if Beta 3 improvements really do solve all of these problems, but Microsoft seems to have put a lot of effort into improving both reliability and security.

The most irritating problem with Windows NT is the number of times you have to reboot your PC when you make changes. Beta 3 lets you make more changes without reboots, such as installing NetWare File and Print Services, adding or removing network protocols, and changing the size of the page file.

To eliminate blue-screen crashes, Beta 3 has added several features, including *kernel-mode write protection*, *code-signing technology*, and *pool tagging*. Kernel-mode write protection prohibits any device driver or application from writing to memory that is in use by the kernel or is marked write-protected by the OS. Code-signing technology works with system file protection and uses a digital signature to verify the source of a file before it is written to the system subdirectory. Finally, pool tagging lets device driver vendors use memory

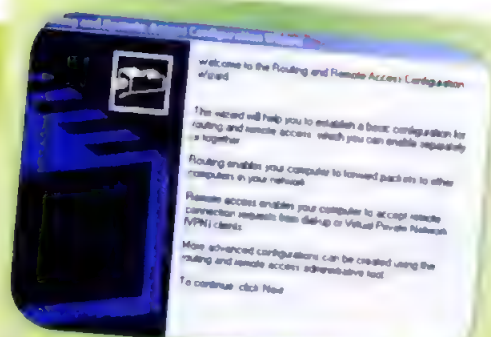
allocations located in a special pool and not in the shared system memory pool.

Another reliability improvement in Beta 3 is the Unix-type kill-service command. You can already use the Task Manager in Windows NT to end a particular process, but it typically requires a reboot. The kill-service utility, however, can terminate a process without requiring you to reboot the client or server PC. And tighter security is achieved in Beta 3 through the addition of enhanced Kerberos authentication, a Public Key Certificate server, and the encrypted file system.

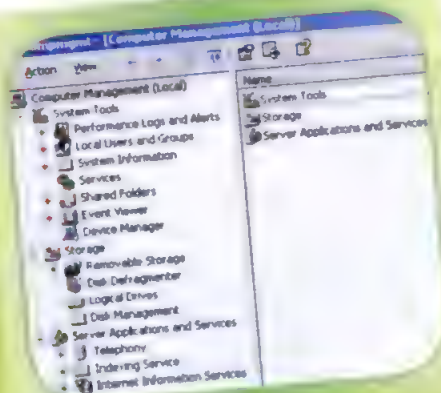
TROUBLESHOOTING

DOS 6.x has one, and so does Windows 95, but Windows NT has never had an option for booting to the command line without loading the GUI. Fortunately, the new System Recovery Console in Beta 3 lets administrators boot to a command line to perform troubleshooting and maintenance by using a hot key or a bootable floppy disk.

The floppy disk method didn't work in the past if you had the Windows NT file system installed, because it's too large to fit on a single floppy disk. Fortunately, Beta 3 lets you use a standard FAT-formatted boot disk to access your NTFS-formatted hard disk. This is a great tool for repairing a damaged hard disk, configuring a non-PnP adapter,



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and scanning for viruses.

Unfortunately, when we tried to log on to our Windows 2000 network from the command line, we were unable to authenticate, because the Directory Services

service had not been started. But most command line tasks don't require a network connection.

Beta 3 also introduces the Safe Mode Boot option. As with Windows 9x, the Windows

2000 Safe Mode Boot lets you start the OS with only the minimum of necessary drivers. This is a useful tool for when you are trying to troubleshoot a misbehaving DLL or service but must

have the GUI running to do so.

A new Beta 3 feature, system file protection, prevents third-party applications from replacing any DLLs located in the Windows 2000 system directo-

Win98 Second Edition: A Boost For Home Networks

Windows 98 Second Edition is a CD-based update to Windows 98 that gathers together a number of the upgrades and fixes already available for download—as well as a new feature, Internet Connection Sharing (ICS). A simple and overdue connectivity feature, ICS finally makes home networking practical. This release of Windows 98 will shortly replace the original version on store shelves (\$109 direct) and preloaded on PCs. It is also available as an update for existing Windows 98 users (\$19.95 direct).

The new release includes updated versions of several key applications: Microsoft Internet Explorer 5.0, NetMeeting 3.0, Media Player 6.1, and DirectX 6.1. It also installs Windows 98 Service Pack 1 and improved USB support. Enhanced IEEE 1394 support, improved Advanced Configuration and Power Interface (ACPI), WebTV, processor optimization, and Device Bay support are also included.

But the big new addition is ICS. ICS is a new networking feature that enables multiple machines on a network to share a single dial-up connection to the Internet.

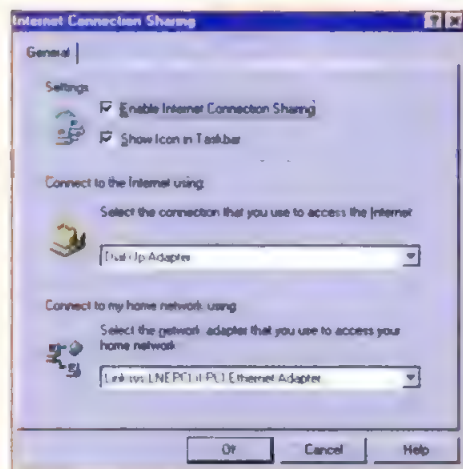
To share an Internet connection, one system is designated the Connection Sharing computer and is the only machine visible to the Internet. Each additional PC on the network can have its own private IP address, but the addresses are not exposed beyond the Connection Sharing computer. When a machine other than the Connection Sharing computer issues a request to the Internet, the request is served up by the Connection Sharing computer, which translates the IP address to its own

before sending it out and translates it back to the requesting computer's when the response arrives. If you turn on automatic addressing on the Connection Sharing computer, it will use the Dynamic Host Configuration Protocol (DHCP) to issue node IP addresses.

The Internet Connection Sharing wizard steps you through the type and name of your Internet connection and creates a client configuration disk. You use this disk to configure the browsers of other machines to share the connection. Once installed on the Connection Sharing computer, new Sharing

and LAN buttons are available in the Internet Properties applet in the Control Panel. Here you can change your settings for the network adapter, connection, dynamic addressing, and proxy servers.

We designated a Dell Dimension XPS T500 as our Connection Sharing computer and a home-built Pentium II system as a client. Installation was as smooth as silk on the Dell, and the configuration disk let us connect other clients in less than a minute. If you don't need connection sharing and require only a few of the bundled updates, save your money and download them. But \$20 is a reasonable price for bringing



your OS up to date—at least for now.—*Stephen W. Plain*
Windows 98 Second Edition Update. Direct price: \$19.95 for Windows 98 users. **Windows 98 Second Edition.** Direct price: \$109 for Windows 95 and Windows 3.1 users. Requires: 24MB RAM, 260MB hard disk space, network adapter (for ICS), Windows 3.1, 95, or 98. Microsoft Corp., Redmond, WA; 425-882-8080; www.microsoft.com.



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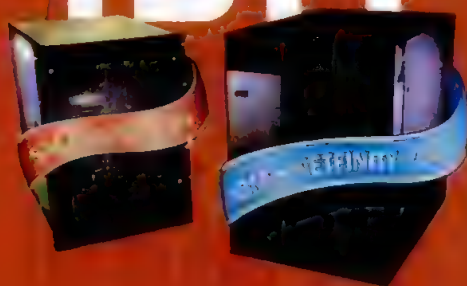


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SAG, the True Winner.

Recently, PC Computing conducted a review matching SAG Electronics' STF Quad Xeon Enterprise Server against IBM's Netfinity 7000 M10. SAG's system more than held its own against PC Magazine's Editor's Choice. The magazine ruled that, "Neither server's performance disappoints. Overall, SAG's Enterprise Server offers a way to get high-end performance for less cash." The AML management tools that come with the Enterprise Server are impressive."

The result of this latest match is just another example of how SAG often meets and beats the "big guys." We offer the perfect combination of personalized service, 100% true customization and leading edge technology...and we deliver it at the best price possible.

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- 512KB Cache, Expandable to 2 CPUs
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- Slots: (6) PCI, (1) ISA, (1) AGP

NEW! 2 IBM 9GB 10,000RPM LVD 4MB Cache Removable HD

- Sound & Ethernet 10/100 by Intel
- Matrix 6400 32MB 4X AGP Video
- IBM 256B 7200RPM DMA 66
- Sony 32X CD-ROM/Max
- Keyboard, Floppy, Mouse
- Full Tower 300 Watt

2635

RGB Remov LVD 10,000RPM Solution 8100

SIX DUAL RAID 400MHz

- Intel Pentium III 400MHz
- 512KB Cache
- 64MB SDRAM, Expandable to 2GB
- Slots: (5) PCI, (2) ISA, (1) AGP

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- 10GB 5400RPM IDE Drive
- Sony CD Recorder - Rewritable
- Matrix G200 16MB AGP Video
- Keyboard, Floppy, Mouse
- Mid Tower Chassis

1650

RGB Remov LVD 10,000RPM Solution 2500

SIX DUAL PIII 500MHz

- (1) Intel Pentium III 500MHz Processor
- 512KB Cache, Upgr. to 2 CPUs
- 128MB SDRAM
- Slots: (5) PCI, (2) ISA, (1) AGP, BX chipset

NEW! 2 IBM 9GB 10,000RPM LVD 4MB Cache Removable HD

- IBM 10GB 7200RPM DMA 66
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- Soundblaster Live
- Soundblaster Speakers
- Diamond V770 32MB AGP
- Keyboard, Floppy, Mouse
- Mid Tower Chassis

1807

RGB Remov LVD 10,000RPM Solution 2500

SIX C450MHz

- Celeron 433MHz w/ 128KB Cache
- 32MB SDRAM
- Slots: (3) PCI, (3) ISA (1 shared), (1) AGP BX Chipset

NEW! 2 IBM 9GB 10,000RPM LVD 4MB Cache Removable HD

- Integrated PCI Soundblaster
- 3MB Nvidia Video
- 9GB IDE Hard Drive
- Sony 32X CD-ROM/Max
- Keyboard, Floppy, Mouse
- Intel Landesk Management Software
- Desktop Chassis

710

RGB Remov LVD 10,000RPM Solution 2500

HIGH RAID RAID SERVER

- (1) Intel Xeon PIII 500MHz Processor
- 512KB Cache, Expandable to 2 CPUs
- 256MB ECC Memory, Expand to 4GB
- Slots: (7) PCI, (1) ISA • Integrated 2MB Video

NEW! 2 IBM 9GB 10,000RPM LVD 4MB Cache Removable HD

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- Integrated 10/100 Ethernet
- Integrated 2MB Video
- 9GB LVD 7200RPM HD
- 32X CDROM/Max, Keyboard, Floppy
- 2U Rackmount 200 Watt Power Supply

3033

WEB CODE: S101 Tower Solutions Available

2U RACKMOUNT PIII 550MHz

- (1) Intel Xeon PIII 550MHz Processor
- 512KB Cache, Expandable to 2 CPUs
- 256MB ECC Memory, Expand to 2GB
- Slots: (6) PCI, (1) ISA (1) AGP

NEW! 2 IBM 9GB 10,000RPM LVD 4MB Cache Removable HD

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6561

WEB CODE: S102 13 Bay Rackmount Solution 11086

SIX DUAL PIII 450 RAID 0-5

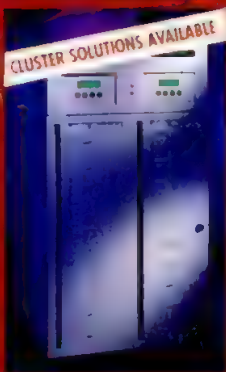
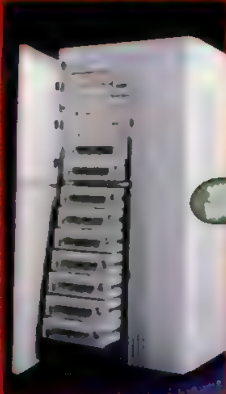
- (1) Intel Pentium III 450MHz Processor
- 512KB Cache, Expandable to 2 CPUs
- 128MB ECC Memory, Expandable to 1GB
- Slots: (4) 33MHz PCI, (2) 66MHz PCI GX Chipset

NEW! 2 IBM 9GB 10,000RPM LVD 4MB Cache Removable HD

- Integrated Adaptec Ultra2 LVD SCSI
- Integrated 10/100 Ethernet
- Integrated 2MB Video
- 9GB LVD 7200RPM Remov HD
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2436

WEB CODE: S103



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- Redundant Power Supplies
- 16MB Cache

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- Power Supply Status
- Cooling Fan Status
- Visual and Audible Alarm

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Q: (3) 18GB 10,000RPM 5.0cm LVD HD 7928

Q: (3) 9GB 10,000RPM 5.0cm LVD HD 6458

STC 20 BAY

- Active/Active Controllers
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- Visual and Audible Alarm

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You can use the **Component Services** console to view all of the COM+ objects on a desktop or server PC.

ries. Applications are allowed to use their own DLLs located in their own directories, but they cannot overwrite Windows 2000 DLLs. Unfortunately, an older third-party application that needs to replace or use an older system DLL will not work with Windows 2000. But luckily, every Windows application we could find, from Corel WordPerfect 6.0 to Lotus 1-2-3 for Windows 2.0, seemed to install and work fine.

Even novices have probably spent time in the Windows Control Panel trying to install or troubleshoot a hardware device. Unfortunately, this usually requires several steps. For example, first you might have to go to the icon for a device, such as a port, to set up the device. If that doesn't work, you have to select the System icon

to see what the problem is.

Beta 3 simplifies this procedure by adding Hardware and Troubleshoot buttons. The Hardware button shows you information not only about the current device but also about all the hardware on your system. The Troubleshoot button brings up context-sensitive help that will walk you through the usual causes of a hardware problem.

IS IT WORTHY?

Small businesses and individuals may find the new features and stable code in Windows 2000 Beta 3 worth the money it'll cost to upgrade from their existing Windows NT-based

PCs. The OS is fairly nonintrusive and should work with most of your applications. You



should check with your third-party application vendors, however, to make sure. Corporate users should probably just set up Windows 2000 on a limited scale in a test environment. The upcoming Y2K issues are enough to keep an administrator busy without having to worry about a brand

new operating system.

Windows 2000 Beta 3. Direct price: \$59.95 (Advanced Server edition, \$19.95 additional). Requires: 32MB RAM (64MB recommended), 650MB hard disk space. Microsoft Corp., Redmond, WA; 425-882-8080; www.microsoft.com/windows/preview/order.asp.

IBM's 3-Pound ThinkPad

The mini-notebook market gains a new contender with the introduction of the IBM ThinkPad 240.

By Carol Venezia

If you're in the market for a mini-notebook, chances are you're looking at either the Sony VAIO 505 or the Toshiba Portégé 3000 series. Now you can add another product to your list: the IBM ThinkPad 240 (tested configuration, \$2,000 street). This new sub-3-pound ultraportable has nearly everything that a road warrior could want, including an integrated 56K modem. All it lacks is battery life.

The ThinkPad 240 is so small that you'll barely know it's in your briefcase. The system measures just 1.3 by 10 by 8 inches (HWD) and weighs a scant 2.9 pounds. Add the AC adapter and the unit's travel weight comes in under 4 pounds; the outboard floppy disk drive—which connects to the left side of the machine via its own connector—adds another half-pound.

Of course, choosing this

small a machine means that you'll sacrifice a bit on a couple of key components. The ThinkPad 240's SVGA display measures just 10.4 inches diagonally, and the unit has only one Type II PC Card slot. But it does have an integrated 56K modem, 64MB of RAM (upgradable to 192MB), and a 6.4GB hard disk. All standard ports—parallel, serial, video-out, USB, and PS/2—are integrated, so you don't have to carry around a port-expander bar as you do with the Sony and Toshiba mini-notebooks.

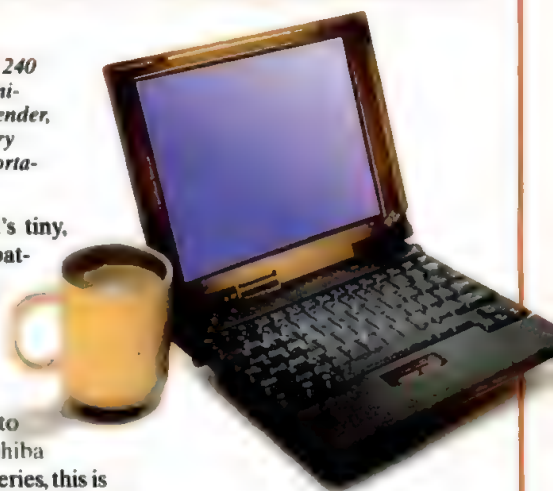
The ThinkPad 240 was also a strong performer on our Winstone tests. Based on a 300-MHz Mobile Celeron processor, the system logged a score of 15, significantly higher than any other mini-notebook we've tested (for comparison, see "State-of-the-Art, Lightweight Portables," February 9, 1999). But unfortunately, on our BatteryMark test, the machine fell flat on its face.

▶ GET A LIFE:

The ThinkPad 240 is a serious mini-notebook contender, but short battery life limits its portability.

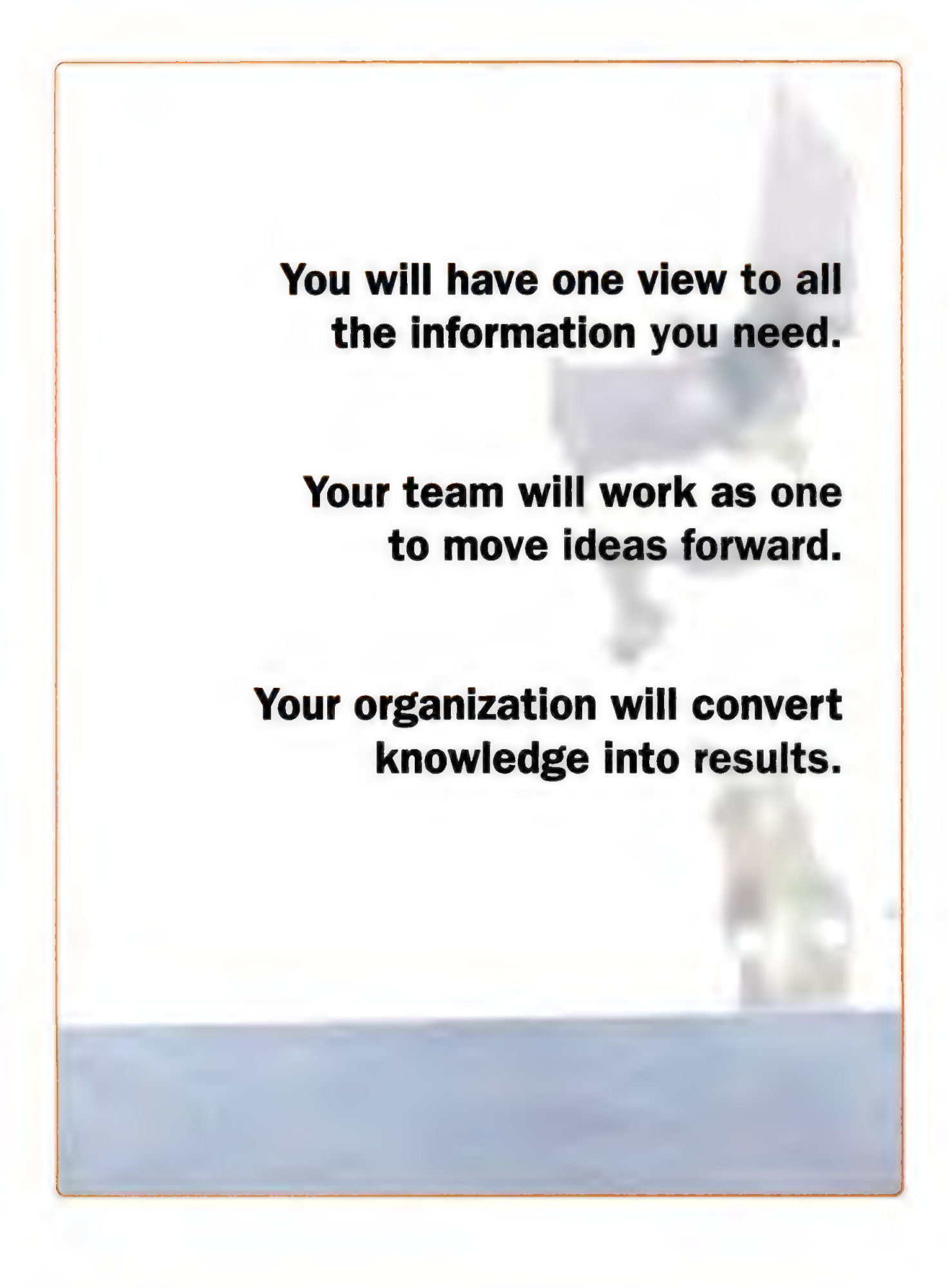
The notebook's tiny, 2,800-mAh battery lasted just 1 hour; compared with the 3-hour timings we've become used to from the Toshiba Portégé 3000 series, this is a serious drawback. Road warriors should consider this point carefully before investing in the ThinkPad 240 (and also consider the handful of extra batteries you may need to power the notebook on a coast-to-coast flight). IBM claims that final shipping units should run for 2 hours on battery power with default power-management settings (our test unit was one step from final hardware).

Short battery life aside, the ThinkPad 240 could pose quite a challenge to Sony and Toshiba in terms of sales. The price is



right, the performance is great, power management works like a charm, and its keyboard (95 percent of full size) is by far the most usable we've found on a portable of this type. Just stock up on batteries or stay near an AC outlet and you'll be fine.

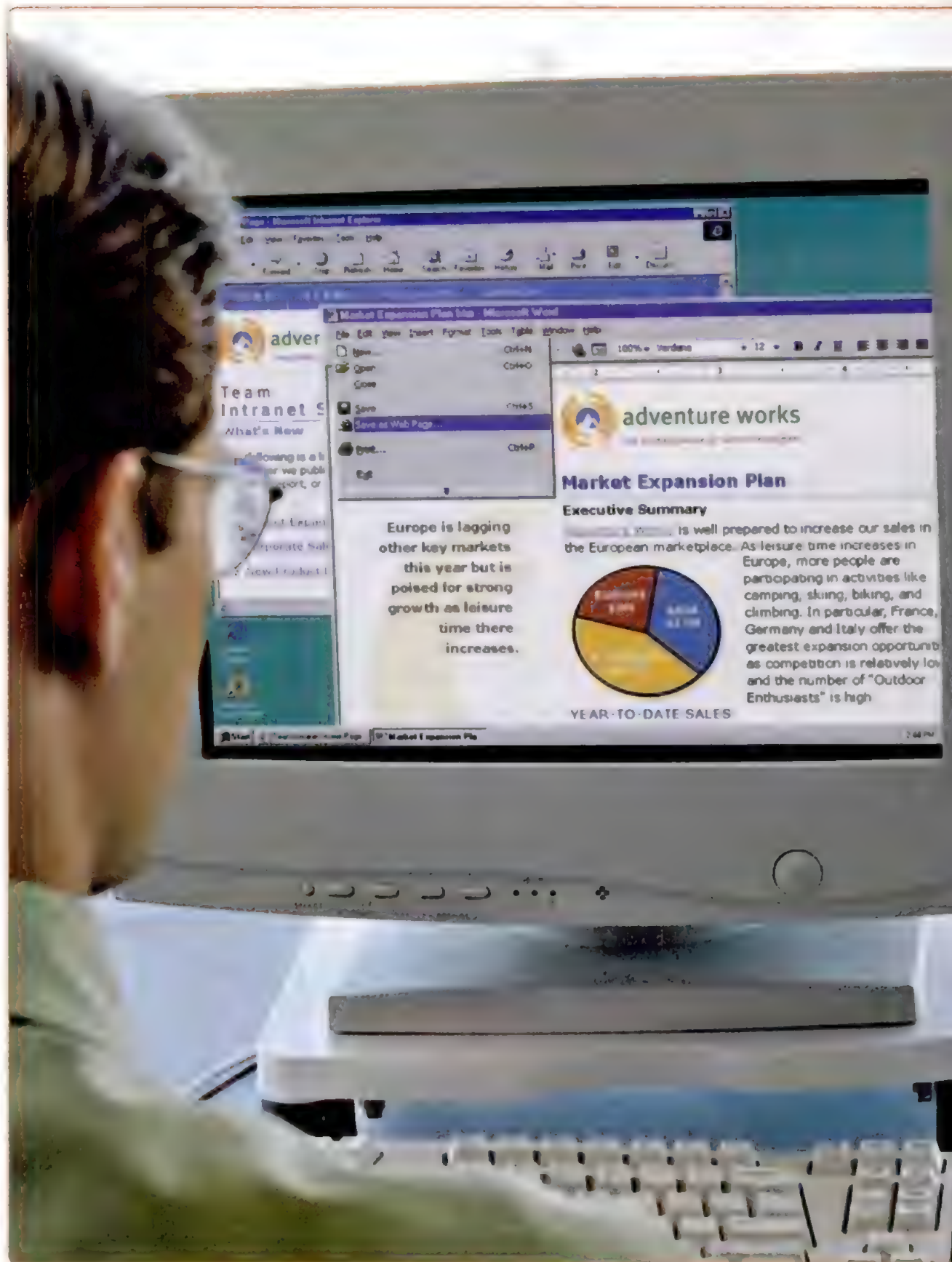
IBM ThinkPad 240. Street price: With 64MB RAM, 6.4GB hard disk, Microsoft Windows 98, \$2,000. IBM Personal Systems Group, Somers, NY; 800-426-7255; www.ibm.com/pc/us/thinkpad.



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knowledge into results.**



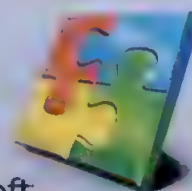
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Help for Small Businesses

Included in Microsoft Office 2000 is Small Business Tools, a useful collection of apps.

By Stephen W. Plain

Regardless of which version of Microsoft Office 2000 you choose—Small Business, Professional, or Premium Edition—you'll gain a new set of integrated tools aimed at common small business tasks. Microsoft's Small Business Tools address customer management, business planning, financial management, and direct mailing. Small Business Tools install as an optional component of Office 2000 and work closely with such core applications as Access, Excel, and Word. The tools are accessible through their own Program menu entries but also add document templates to the Office 2000 applications.

The Small Business Customer Manager (SBCM) is an important addition. It integrates your Microsoft Outlook contacts and accounting system data to provide a central repository for analysis, publishing, and document creation based on the information.

Although SBCM uses Access as its backbone, it has a unique interface. Predefined data views called Select Views display common reports, such as Top Salesperson, Product Sales by Region, Customers by Product Ordered, and many more. Word and Publisher document templates are also included.

The Microsoft Business Planner is another new creation. It combines the usual Microsoft wizard user interface with links to online information resources and indexed content from five marketing and business planning reference books. The application and online content is organized by Finance, Legal, Marketing, Operations, and Planning. As you work in the wizards, you can create related Office 2000 documents based on the more than 100 Word and

Excel templates available.

The Small Business Financial Manager is an upgraded version of the Excel tool, which includes a What-If analysis, Buy vs. Lease Wizard, predefined charts, and financial projections based on the imported accounting data. To generate mailings, the **Direct Mail Manager** guides you through importing your data, verifies address validity online, and prints your mailing documents. This program interfaces with postage services and is a handy way to get big mailings out fast.

The tightly integrated features of the component applications expect your organization to run almost exclusively on Microsoft documents, and the back and forth between applications can become confusing. But there's likely something in here to benefit any company. This melding of application features and informative content offers a glimpse into the future of office suites.

Microsoft Office 2000 Small Business Tools. Included with all ver-

[illegible]

▲ JOIN FORCES: SBCM integrates information from contact entries and accounting system data.

sions of Microsoft Office 2000. Microsoft Corp., Redmond, WA; 425-882-8080; www.microsoft.com/office.

Simplified Mobile Printing

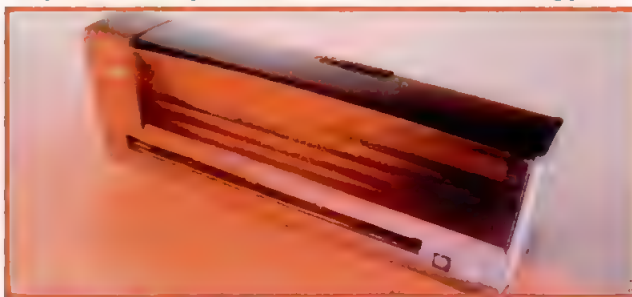
Brother's new mobile ink jet printer improves the field, but slow printing limits its usefulness.

By Bruce Brown

There's a welcome addition to the paltry field of portable printers. The Brother MP-21C Mobile Color Ink Jet Printer (\$300 street), with a piezoelectric printhead, simplifies connections and minimizes the number of parts you need to carry. The MP-21C produces at-

ple. Two ink cartridges (one for black and cyan, the other for magenta and yellow) snap in easily. Paper feeds from the rear of the printer, one sheet at a time, and comes out of the front. A lack of input tray makes paper feeding a bit troublesome, and the printer also lacks an output tray.

The MP-21C's strong point is



▲ CARRY IT OFF: The Brother MP-21C is ready for travel, at only 2.5 pounds. It requires just a single PC connection to print.

tractive text, color graphics, and photo images, but it prints slowly.

The printer is compact and ready to travel: It's 4.2 by 11.8 by 2.0 inches (HWD) and weighs 2.5 pounds. The 720-dpi-maximum MP-21C uses a single PC connection, via an included PC Card and cable, for both power and data.

Operation and setup are sim-

print quality. Black text printed in its highest-quality mode (720 dpi) looks great, with minimal fuzziness and dark print. Text printed in standard (360-dpi) mode isn't as dark or sharp. Color graphic print samples are comparable with the output of most desktop printers, and even color photographic images are

good, although there's minor banding and a little red color-balance pushing.

You'll have to wait for the output, however. A single page of 720-dpi text took 7 minutes 30 seconds and a 7.2-by-9.4-inch photo print took 17 minutes 35 seconds to print. Typically high for portable printing, the MP-21C is rated at 6.4 cents per page for 5 percent black text printing and 27.6 cents per page for 15 percent color coverage.

You can buy a 30-page sheet feeder (\$80 list) and a combo pack with an AC adapter and a desktop-to-printer cable (\$50 list), but the smarter way to improve on the base model is to buy the upgraded MP-21 Cdx. At \$350 street, it includes a sheet feeder, an AC adapter, and a parallel cable.

The Brother MP-21C Mobile Color Ink Jet Printer improves the field with its single data and power connection. But slow printing and limited paper handling detract from its usefulness to vertical markets where hard-copy output is essential and to those who are space-constrained. **Brother MP-21C Mobile Color Ink Jet Printer.** Street price: \$300. Brother International Corp., Bridgewater, NJ; 877-284-3238; www.brother.com.

Designs on Your Desktop

Improved productivity is the focus of AutoCAD 2000, the newest version of an industry standard.

By John McCormick

Despite strong competition, Autodesk's AutoCAD remains the world standard for high-end computer drafting. This alone makes the introduction of a new version noteworthy, but is AutoCAD 2000 (\$3,750 list) an important advance? If your goal is to increase productivity, then you'll want to upgrade—because this release isn't just new, it's significantly better.

► POWER: DesignCenter lets you locate and reuse elements from other drawings.

Improving the interface between what is essentially a graphics task and the keyboard is always a challenge, one which even graphics

tablets can only partially meet. To be productive, you need software oriented not to the keyboard but to the drawing, and the latest release of AutoCAD is a major effort to improve the interface through Autodesk's 2D-to-3D design.

At start, the new design offers a host of drawing tools and options available from context-sensitive menus, full support for the new software IntelliMouse, and an expanded right-click menu that works as it does in Microsoft Windows. Among the hundreds of changes and enhancements in this version, the most critical are the speed AutoCAD's most common jobs and automate routine tasks.

FEATURES

Multiple Design Interface (MDI) is Autodesk's name for the new ability to view multiple

drawings in the same session, which lets you move objects between drawings using a simple drag-and-drop operation. MDI is an important advance but is long overdue. (Here, Autodesk is catching up with far less expensive programs such as Visio Corp.'s IntelliCAD98.)

AutoCAD 2000's DesignCenter is an even more powerful productivity tool. Like MDI, DesignCenter provides a way to move objects between drawings.

But it goes much further by letting you search for and copy design elements such as blocks, layers, and xrefs (external references) from a local PC, over a network, or even from Internet locations.

The Object Properties Manager (OPM) takes about 40 commands and dialog boxes that designers would have to access separately in AutoCAD Release 14 and puts them on one form, where you can modify nearly any object property and quickly edit dimension properties. The Drawing Properties dialog box lets you embed comments, author name, title, and subject name in a hidden attachment, which can be seen either within AutoCAD or via the Windows Explorer Properties tool. Drawing Properties entries

can be searched for in the DesignCenter, making it easy to locate and reuse old drawings.

SAVING TIME AND WORK

CAD files can be very large, and users almost always work with small pieces of larger drawings. New to AutoCAD 2000 is the ability to load only a prenamed piece of a much larger drawing, which can save a lot of time. Also new is 3DOrbit, which provides real-time viewing and editing of wireframe or rendered 3-D models from any angle—even on slower computers.

Adding consistent-style text labels to all the elements in a drawing is vital but time consuming; a new global find-and-replace tool makes this task easier. Symbols can now have names up to 255 characters long—a useful

supported, and the plot dialog box is all new.

The VisualLISP integrated design environment can customize nearly everything from toolbars to individual objects. You can now apply line weight directly to objects or layers instead of mapping colors to pens at plot time. You can also combine multiple files in a single file with multiple layouts and even reproduce drawings in 24-bit true color.

Full documentation is online, and you'll receive a separate Learning Assistance CD. The only print documentation included is the installation guide, the 900-page user's guide, a digitizer tablet template, and a quick reference card. The AutoCAD 2000 documentation pack, with print versions of all manuals, costs \$49.50.

The most important changes,

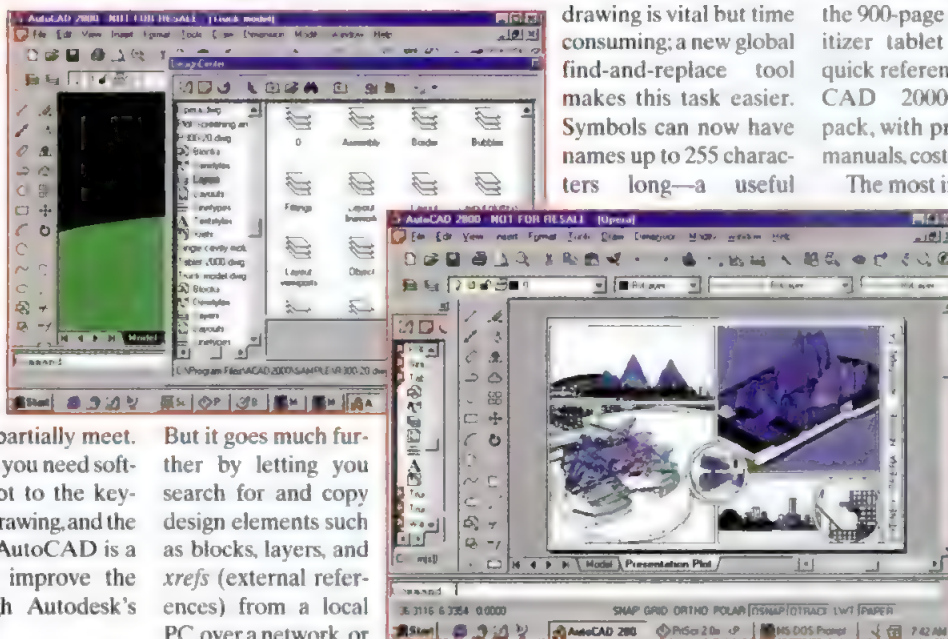
◀ 3-D EDITING:

This is the Sydney Opera House rendered in 3DOrbit where it can be manipulated in real time.

from a productivity standpoint, in AutoCAD 2000 are the ease of locating and reusing the content of other drawings and

the improved interface for modifying object properties. These alone make the new version of AutoCAD worth the upgrade price. For new buyers the decision isn't as clear cut. AutoCAD 2000 is the world class of CAD, but a low-end package might meet your needs as well.

AutoCAD 2000. List price: \$3,750; upgrade from Release 14, \$495; upgrade from Release 13, \$695. Requires: 32MB RAM, 200MB hard disk space (including 64MB swap space), Windows 95, 98, or NT. Autodesk Inc., San Rafael, CA: 800-964-9432; www.autodesk.com.



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E-Commerce, No Coding

Small to midsize Web stores can be customized easily with eStore Builder for Drumbeat 2000.

By Gary Gunnerson

Do you want to get your store online quickly and easily with a standard format, or are you willing to spend more time and money for a customized solution? No need to answer: With eStore Builder (\$399 list) for Drumbeat 2000, Elemental Software carves its niche in the middle ground.

Existing Drumbeat users will recognize the standard features of Drumbeat 2000, powered by ASP (active server pages), with eStore Builder folding commerce functions into the mix. You still have easy WYSIWYG layout of design elements, and you simply shift-click on several elements to expose their potential interactions.

Drumbeat's eStore Builder offers the expected online e-commerce elements including a complete and secure shopping basket, shipping and tax calculations, and SET (secure electronic transaction) credit card clearing. It differs from other e-commerce solutions in its extensive customization features and easy database integration. For example, with its flexible and persistent shopping cart, objects placed in the cart will remain there, even if the shopper's connection is interrupted.

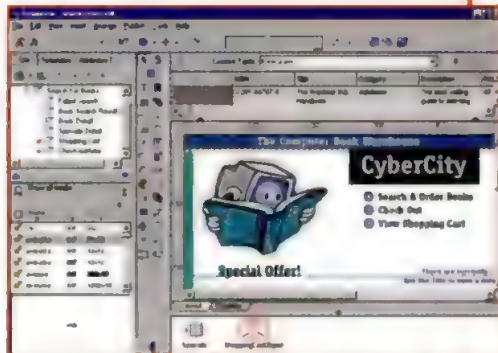
The claim of no coding is true, but you will need expertise with database design and familiarity with programming objects and their properties. Drumbeat exposes the methods of these objects in an intuitive fashion,

► ON THE BEAT: eStore Builder keeps all tools within easy reach, including a full WYSIWYG view.

making object-oriented programming approachable for even occasional programmers.

Drumbeat's eStore Builder relies on ASP. Unfortunately, active server pages do not scale well to larger-capacity Web sites of multiple servers, and Drumbeat does not provide the ability to coordinate content in these instances. Nor does Drumbeat offer group programming options; instead, it lends itself well to final assembly of already prepared Web assets.

The tutorials go a long way toward easing consummate Web pros into the e-commerce fold. eStore Builder provides a



great solution for enabling e-commerce for existing Drumbeat Web sites. Others looking for a small to midsize fully customizable Web commerce solution should look no further—eStore Builder delivers.

eStore Builder for Drumbeat 2000. List price: \$399. Bundle of Drumbeat and eStore Builder: \$599. Requires: 32MB RAM; 30MB hard disk space; Microsoft Windows 95, 98, or NT 4.0. Elemental Software, Carlsbad, CA; 877-378-6232; www.drumbeat.com.

From 2-D to 3-D with Ease

Turn 2-D photos and illustrations into 3-D models painlessly, with MetaCreations' Canoma.

By Daniel Grotta and Sally Wiener Grotta

MetaCreations' Canoma (\$500 street) is a deceptively simple program that creates photo-realistic 3-D models from 2-D photos and illustrations, without the effort usually associated with 3-D programs. Not intended as a precision tool, Canoma's models and animations are

good enough for quick visualizations and for displaying products for e-commerce.

Canoma works by placing the vertices of primitive 3-D shapes into 2-D pictures (BMP, GIF, JPEG, PNG, PSD, or TIFF). For instance, the corners of a box and those of a roof-shaped polygon are pinned to the corners of a building. If corners are not visible in the picture, easy-to-use side "beads" are attached to make sure that the edge aligns to the correct perspective.

Canoma then

◀ TRANSFORM: Start with a 2-D photo or illustration, then place 3-D wire-frame primitive shapes.

maps the photograph onto the wireframe primitives to create a 3-D building. Add more primitives and you will have a 3-D scene. More than one photo or illustration can be used to add the back sides of the scene and to increase the level of detail. The result, though often not perfect, is an impressive, rotatable model.

Once you have your model, creating a fly-through animation is as simple as using intuitive mouse controls for zooming, scaling, banking, panning, and rotating—then clicking to define keyframes. Our rendered QuickTime movie was attractive and pleasing.

Although Canoma is probably the easiest-to-use 3-D modeling program we've seen, it still takes practice to place the primitives correctly, especially in complex scenes. More significantly, its library of 3-D primitives is limited to a few polygons, and has no curved shapes—not even a sphere.

The 3-D models can be ex-

ported as Autodesk, DXF, Poser prop, SCN, trueSpace, Wavefront obj, or VRML2 files for use in more sophisticated modeling programs. In addition, a scene can be rendered back to a 2-D image as a BMP, JPEG, PNG, PSD, or TIFF file. But its primary export is to the Meta-Stream file format, the new kingpin of MetaCreations' software line. MetaStream is a distribution system for interactive 3-D graphics, in which the models can be as complex or as simple as the bandwidth of the individual viewer's browser. Surprisingly, Canoma cannot open or import any 3-D files from formats other than its own proprietary 3DV.

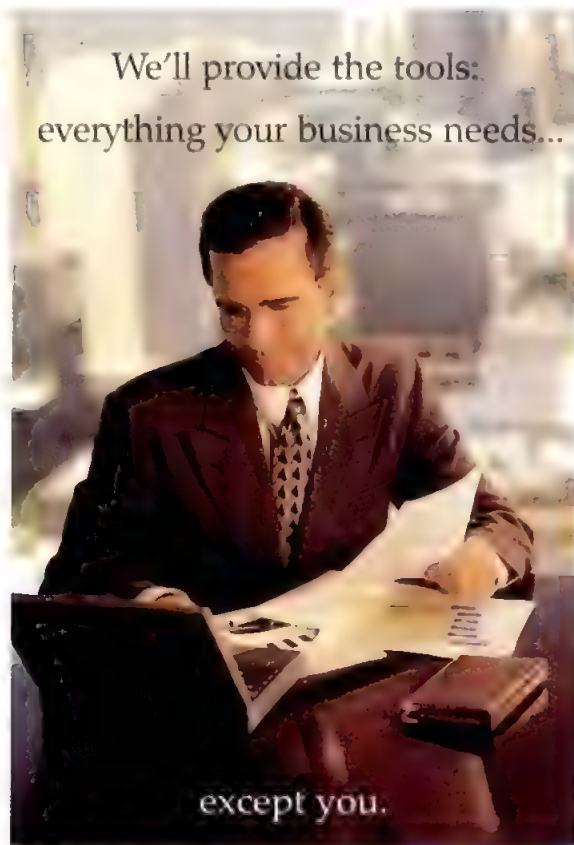
Now that it's so easy and fun to create 3-D scenes (and to share them using MetaStream), 2-D will be considered flat.

Canoma. Street price: \$500. Requires: 32MB RAM; 50MB hard disk space; Microsoft Windows 95, 98, or NT 4.0. MetaCreations, Carpinteria, CA; 800-846-0111; www.metacreatifons.com.



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Two Renewed Browsers

Communicator gets streaming media and Digital City integration, while Opera speeds along.

By Jim Lynch

Some time ago, the viciousness of the browser wars seemed to indicate that there was room for only two: Microsoft Internet Explorer and Netscape Navigator. No one expected a third browser to join the fray, but we're pleased to report that Opera is alive and well. Netscape Communicator 4.6 (free download at <http://home.netscape.com>) is the first AOL update to the Netscape browser suite, and it contains a strong AOL influence. Opera 3.6 (\$35 list) adds new features and fixes to its vaunted speed.

AOL claims that, when used over a modem, Communicator 4.6 is faster than IE5 at loading pages from the top 100 Media Metrix Web sites. We tested this claim at a number of leading sites and found virtually no difference between load times for the two browsers. If speed is your bottom line, though, you should give Opera a try. Just remember that this browser has a price tag attached.

NETSCAPE COMMUNICATOR 4.6

No one could accuse AOL of letting the grass grow beneath its feet. And so it goes with AOL's integration of Netscape products. Communicator 4.6 includes a number of bug fixes, speed increases, beefed-up security, integration with AOL's Digital City content, the addition of the RealPlayer G2 streaming media

player, and a stronger What's Related feature.

AOL has improved stability through the elimination of scores of bugs left over from prior releases. Security has also been strengthened, with 56-bit encryption standards added to the Communicator suite (a 128-

ready bundling a version of its Windows Media player in Internet Explorer). RealPlayer G2 is a definite value-add to Communicator. You won't have to download a separate application to access rich media content.

One of the most useful features included in the prior version of Communicator was the What's Related tool. AOL has added significant value by including such information about sites as its ownership and pop-

can now search on terms such as *New York movies* or *Boston newspapers* to get localized content links. We found this feature extremely helpful and easy to use: We just typed our search terms into the URL address box in Communicator and the browser automatically pulled up the closest matching content from Digital City, Netcenter, or the Open Directory.

Communicator 4.6 offers enough new features, tweaks, and bug fixes to be worth downloading for anyone running an earlier version of Netscape. Internet Explorer users should also take a look, although there's probably not enough in this release to convince devoted IE5 users to switch.

Netscape Communicator 4.6. Price:

Free download. Requires: 32MB RAM, 29MB hard disk space, Windows 95, 98, or NT. Netscape, a subsidiary of AOL, Mountain View, CA; <http://home.netscape.com>.

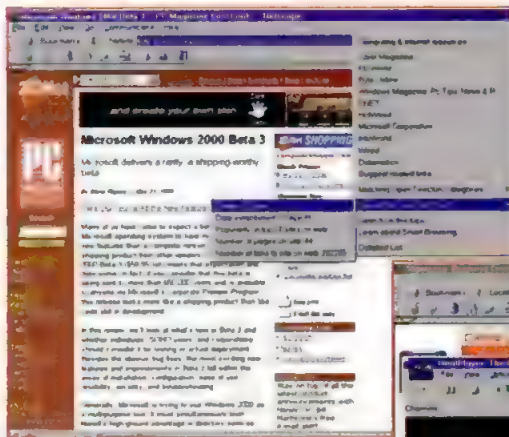
OPERA 3.60

One of the best things about Opera is its configurable interface. The latest version has a tweaked interface that includes new buttons, giving it more of a 3-D look. And hats off to Opera Software for running a buttons contest on its site, a great way to involve customers in browser design. Be sure

to check out the many button entries at Opera's Web site, www.operasoft.com/buttons.html.

Opera Software has made some other small but useful changes. You can now easily disable the annoying Confirm Exit dialog box, and you also get the convenience of having Opera automatically close its dial-up Internet connection on exit.

IntelliMouse support has been strengthened as well: You

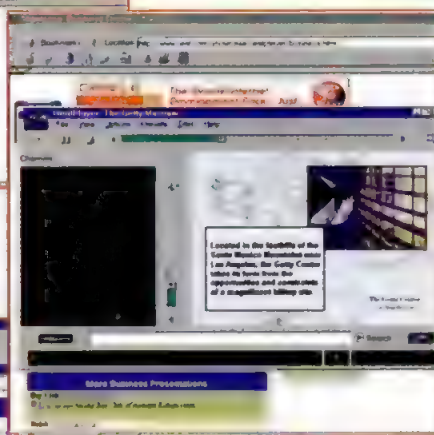


▼ **FACE-LIFT:** Opera now has configurable 3-D buttons; you can download additional sets of buttons or create your own.



▲ **FOR REAL:** The RealPlayer G2 streaming media player is now bundled with Communicator, so finding and experiencing rich media content is easy.

CONTEXT: What's Related now shows a site's popularity, history, and ownership; you can search for additional sites or view news related to the site you're visiting.



bit version is available in Canada and the U.S.). In addition, AOL has corrected potential security vulnerabilities that had been independently reported by outside programmers.

Teaming up with RealNetworks, AOL has included RealPlayer G2 in this release. This is a smart move that directly addresses a competitive weakness in the suite (Microsoft is al-

view related news stories, do a fast search, and view matching categories in Netscape's Open Directory. If you're a frequent user of this feature and are still running Version 4.5, you'll definitely want to upgrade for these goodies.

AOL has also tweaked Communicator's Internet keywords by integrating them with AOL's local Digital City content. You

can now zoom in or out and go forward or backward in your history file by using a combination of keyboard and mouse wheel. These small changes are reflective of the company's desire to please its customer base by responding directly to user requests.

The Hot List (bookmark) window has also been updated. You can import bookmarks from Netscape or Favorites from Internet Explorer directly via the Hot List window. You can also create new Hot Lists and save your Hot Lists from the window. Although these are useful changes, Internet Explorer's bookmark management system still beats Opera's

(and Communicator's). We hope to see this feature improved in future versions.

Opera Software has fixed numerous bugs in this release. Among the fixes are tweaks to Global History, Hot List, and JavaScript. Users of Opera who have been experiencing problems in these areas should definitely download this latest update.

Opera hasn't lost any speed in this release. The browser still feels faster when loading pages than Communicator or Internet Explorer. Bear in mind, though, that you won't get the bells and whistles bundled in IE or Communicator—including Java (you have to download a separate

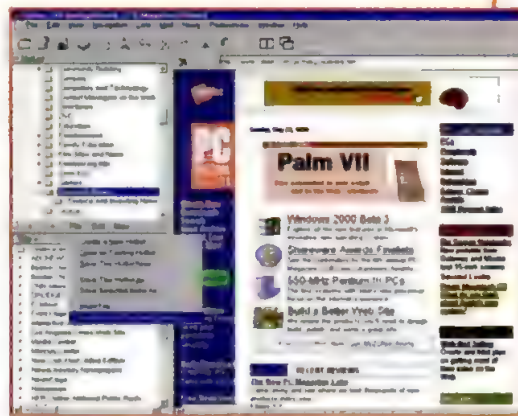
► MARK IT: Opera's Hot List feature has been updated, making it easier to import external bookmarks right from the Hot List window.

plug-in for Java support), streaming media, or robust e-mail clients. But if all you want is a lightweight, fast way to browse pages, then those things don't matter.

Opera has carved out a small but important niche in the hearts—and hard disks—of browser users. If you're looking for a fast alternative to the big

names, be sure to give Opera's 30-day free trial a spin.

Opera 3.60. Price: \$35 list. Requires: 4MB RAM, 3MB to 7MB hard disk space, Microsoft Windows 3.x, 95, 98, or NT 4.0 or later. Opera Software, Kjeller, Norway; +47 (1) 216 229 4382; www.operaoftware.com.



Smooth Mailing With ELetter

Someone once said that the only two times your brain absolutely ceases thinking is when you're waiting for a traffic light to change and when you're waiting for your PC to boot. But there may be a third: when you're sitting at a table, folding, stuffing, stamping, and addressing a bulk mailing. Brain activity will slowly begin again after the last envelope is sealed, when you start to realize just how much time and money you may have wasted.

Now, there's a better way. ELetter (the company), in conjunction with a team of respected industry individuals and organizations, recently launched ELetter, an innovative new way to create, lay out, address, and mail individual or mass mailings without so much as standing up from your desk chair. Depending on your needs, the time ELetter saves coupled with potentially lower postal costs is bound to improve your company's bottom line.

Your part of the process is easy. Head to the Web site (www.letter.com) and follow the step-by-step instructions by clicking buttons and entering data in the fields supplied. You can create individual or multiple letters, postcards, or booklets. There are some restrictions related to document characteristics such as fonts and images; these are spelled out quite thoroughly in the help files, and the modifications required shouldn't be difficult.

Next step: Enter the recipient address(es) or browse for the filename of your address list. To ensure against sending

mail to incorrect addresses (especially helpful if you're buying mailing lists from an outside source), ELetter verifies each mailing address using a USPS database and alerts you to potential problems. You can upload mailing lists to ELetter in several formats: Comma Separated Values (CSV), Microsoft Access and Excel, and Visual FoxPro.

Once you've identified the recipient(s), ELetter will want to know what you'd like to say. Simply name the file containing your document and ELetter's automated system takes

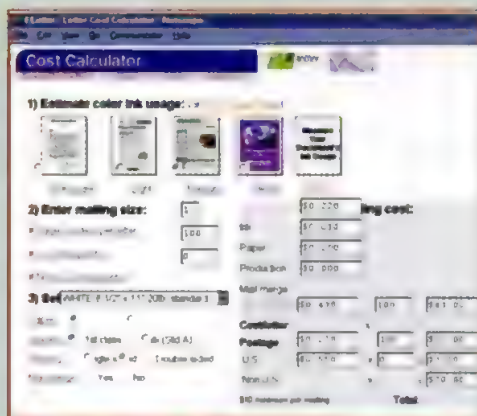
care of the formatting and shows you a proof of the finished product.

Pricing depends on several variables, but here again, the site's design makes calculating the cost of your mailings clear: You'll have to supply answers to questions such as number of pages and U.S. and non-U.S. recipients, paper type (few options here), delivery method (first class or bulk rate, and so on), single- or double-sided pages, and whether the process involves a mail merge.

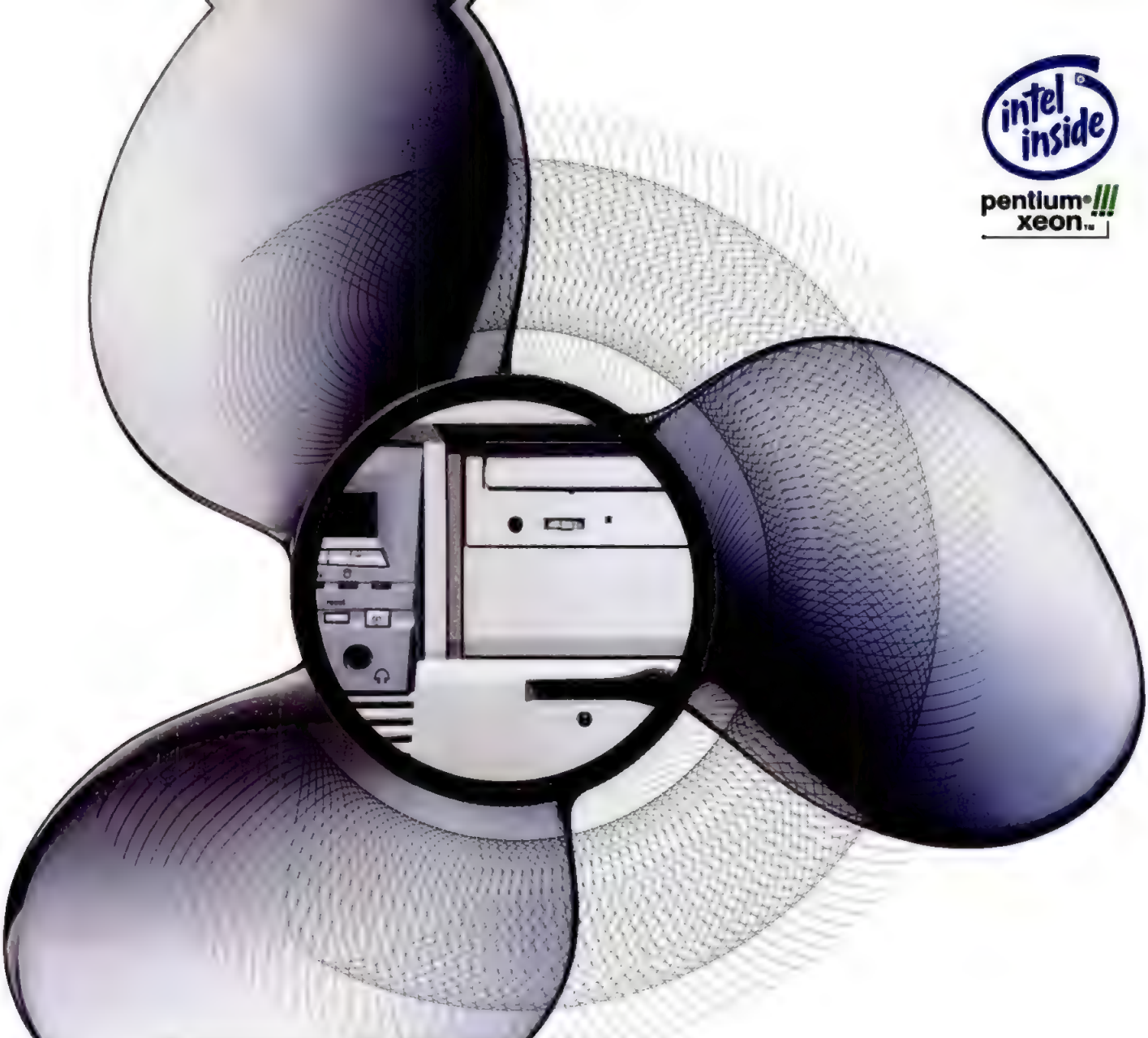
ELetter's nifty calculator updates the price before your eyes as you experiment with different options.

ELetter offers an unconditional 30-day money-back guarantee for mailings. That kind of risk-free offer makes it difficult not to give ELetter a try.—Kathy Yakal

ELetter. Price: Varies depending on mailing attributes; postcards start at \$0.14 each, letters at \$0.26, 8-page booklets at \$0.80. ELetter Inc., San Jose, CA; 877-353-8837, 408-918-9180; www.letter.com.



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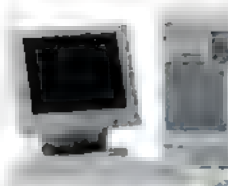
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Top Pro Graphics

Version 9 of CorelDraw is improved and expanded, and painting is still a creative pleasure.

By Daniel Grotta and Sally Wiener Grotta

The CorelDraw 9 graphics suite (\$695 list) is jam-packed with enhanced productivity and creativity, in a more efficient interface than that of CorelDraw 8 (an Editors' Choice winner in "Professional Graphics," September 22, 1998). Key improvements are in compatibility, color management, Adobe Acrobat and Web output, workflow, and convenience—and, of course, artistic tools.

Corel Corp. continues to expand this enormous suite. In addition to its two central programs—CorelDraw and Photo-Paint—are numerous graphics and production utilities, plus more than 25,000 pieces of clip art, photos, and fonts. Microsoft Visual Basic for Applications 6.0 macro editor and player are now directly accessible from within CorelDraw and Photo-Paint.

Included also is Canto Cumulus Desktop LE 4.0, an asset-management system that catalogs more than 110 file formats (for images, documents, QuickTime movies, and more). Offering an alternative to the cumbersome Twain interface (though that's still supported), Corel now uses the ixa Digital Camera plug-in, which provides drivers for more than 120 cameras. And the number of links to support Web sites has increased significantly, including online access to fonts, color profiles, printer and camera drivers, and scripts.

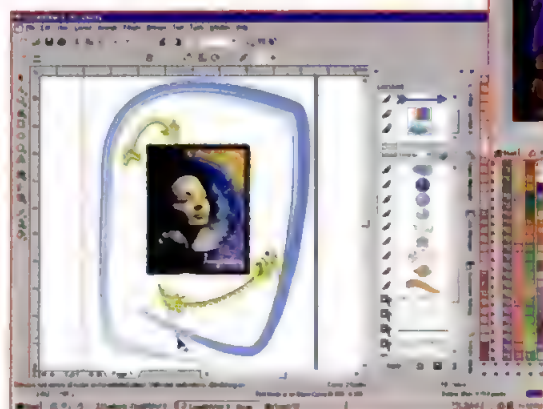
INTERFACE IMPROVEMENTS

CorelDraw's interface has been streamlined to give greater accessibility to controls. Rollup palettes have been replaced, putting all commands and options in the Property Bar or in Dockers (tabbed palettes that

can be "docked" to the right of the workspace).

Numerous color palettes can now be displayed as scrollable ribbons along the right side of the screen, for easy access to specific types of colors (for the Web, desktop printers, prepress, and so on). But rollover ID and right mouse clicks work only in a small spot at the top of the ribbon.

Color management, based on Kodak Digital Science, now lets you set the internal RGB. And when you save in TIFF, JPEG, EPS, or one of Corel's proprietary formats, a check-box option embeds the current ICC color profiles. In addition, Corel can read embedded ICC pro-



files from other applications, helping to maintain color consistency.

BETTER TOOLS

Creative tools and commands have been simplified and expanded. For instance, the Uniform Fill dialog now has all the options for that tool in a tabbed palette. Also, in the illustration application, one mouse click in Uniform Fill adds the current color to any open, editable palette.

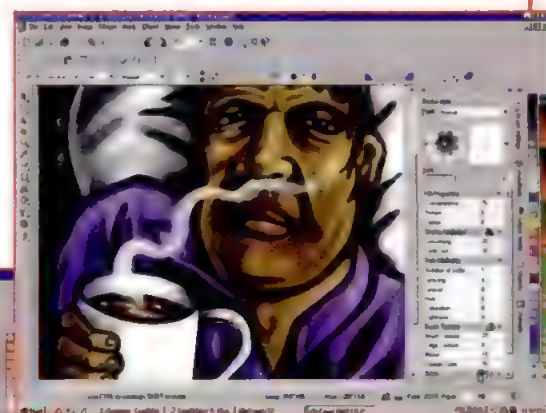
CorelDraw 8's Natural Pen tool has been extended and renamed Artistic Media; it places shapes, effects, calligraphic lines, or images along an editable Bezier curve. You can create fun

and attractive strokes, such as a loopable rainbow or pictures that bend, with full control over size, shape, and other options.

Other enhancements include a new Mesh Fill tool, which can apply gradient colors along a customizable grid of user-definable nodes, and more accurate and convenient drawing tools. Photo-Paint corrections and special effects are now available within CorelDraw, so an embedded bitmapped image no longer has to be moved to Photo-Paint for editing.

► CREATE A SCENE:

Photo-Paint reorganized its control palettes for easy access to its power and versatility.



◀ SCROLL A COLOR:

Many of CorelDraw's color palettes can now be displayed as scrollable ribbons.

Several of Photo-Paint's key control palettes have been reorganized, for easier access to its power and versatility. The Brush Settings Docker replaces the prior version's tabbed Rollup. And the new Undo/Redo Docker saves all your actions in editable scripts that can be used by CorelScript or the Visual Basic editor.

New Web tools are intelligent and well organized. An easy-to-use utility converts paragraph text to HTML, and the generated text remains editable. The HTML conflict analyzer checks for object intersections, HTML compatibility, external links, and so on. And the links manager

maintains a list and status of all hyperlinks, bookmarks, and external bitmap links.

PREPRESS

CorelDraw 9 also gives greater attention to the details of prepress. The Prepare for Service Bureau wizard now automatically packages all the needed files for the document. And there's better Postscript support, for improved trapping and imposition compatibility.

The new Publish to PDF feature is both powerful and sim-

ple, including options for setting the level of JPEG compression and bitmap sampling for images, control over fonts and color management, and more. PDF settings can be saved as a style to be applied to future exports.

Corel has increased its effort to improve output for desktop printers and service bureaus. For instance, a Preflight tab in the print dialog checks your document for possible printing problems and offers suggestions on how to correct them.

CorelDraw 9 is a powerful, professional tool that pays attention to the details of production and therefore can pay for itself very quickly—and it's even fun to use.

CorelDraw 9. List price: \$695 (competitive upgrade, \$199 list). Requires: 32MB RAM, 100MB hard disk space, Windows 95, 98, or NT 4.0. Corel Corp., Ottawa; 800-772-6735; www.corel.com.

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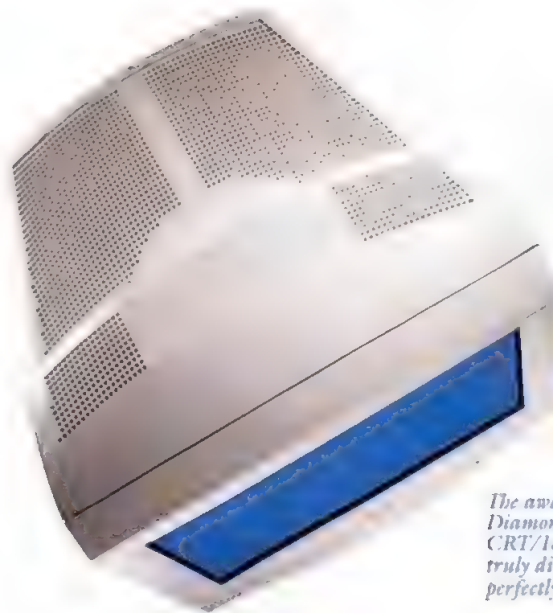
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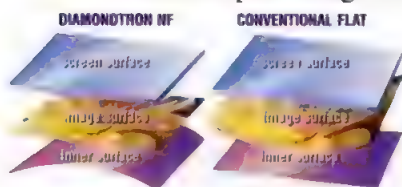
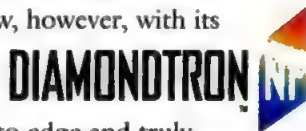
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Natural-Media Painting

Deep Paint offers a realistic painting experience and can be used as a Photoshop plug-in.

By Daniel Grotta and
Sally Wiener Grotta

Deep Paint (\$250 street) from Right Hemisphere is the first program to challenge MetaCreations' Painter as the top natural-media painting software. Although Deep Paint's features aren't as wide-ranging, its highly customizable brushes are superb, with an impressive depth of controls. These are easily accessible in palettes that are more intuitive than Painter's.

Deep Paint acts like a 3-D painting program for 2-D images, applying a material's properties—color, bump (texture), and shine (luminance)—to every stroke, in real time. As far as we have been able to determine, it is the only 2-D materials-based system available.

The program's brushes emulate traditional art techniques such as impasto, oil, chisel, watercolor, and charcoal. Two hundred default brushes are included, and you can create and save new brushes, controlling strength, feather, rotation, reaction to your stylus tilt and direction, and numerous other options.

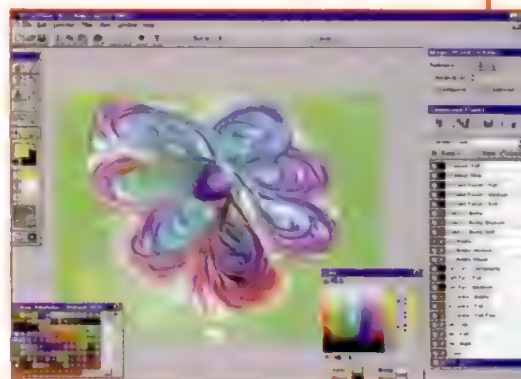
Deep Paint is a serious artist's tool, especially when used with the Wacom Intuos Intelligent Tablet System (reviewed in "Put Pen to Paper Digitally," First Looks, November 3, 1998, page 61). With the Intuos System, Deep Paint's airbrush stylus feels and acts like a real airbrush.

Cloning can be exact or artistic, using any of your brushes, set to color, bump, or shine. Mask-

ing, though, is not up to current standards (for example, you can't save your mask).

Deep Paint's workflow is more streamlined than Painter's. The program can be nicely integrated into Photoshop as a plug-in, or it can be used as a standalone application. The interface follows Photoshop protocols, including layers and hotkeys. Requiring about 10 times your image size in RAM, Deep Paint is a memory hog. That's because it is creating not only color but also thickness and luminance.

Painting is Deep Paint's only focus, which it achieves with remarkable power and artistic excitement. Used optimally, Deep



▲ **REALISTIC:** Deep Paint's natural-media brushes react the way their real-world counterparts do. Here, the oil smears into other brush strokes, raising ridges in the shiny viscosity.

Paint becomes integral to the Photoshop workflow. And for painting and cloning alone, Deep Paint is a superb tool that promises to get even better.

Deep Paint. Street price: \$250. Requires: 64MB RAM, 20MB hard disk space, Windows 95, 98, or NT. Right Hemisphere, Bellingham, WA; 877-309-3204; <http://us.righthemisphere.com>.

Precision OCR

TextBridge Pro 9.0 is even more accurate and easy to use than ever.

By David Haskin

Like its OCR competitors, ScanSoft's TextBridge Pro 9.0 still is seeking perfect accuracy in converting scanned pages to editable text. But this upgraded version is more accurate and simpler to

use than its predecessor, and it provides greater flexibility.

TextBridge's greatest strength remains its ability to maintain complex page layouts. For instance, a page in our test stack had one column at the top, three columns in the middle, and four

columns below that. A more complex page had a slanting left margin that wrapped around a graphic image. In both of these cases, TextBridge maintained page formatting perfectly after recognizing the text and exporting the results into other applications, such as Microsoft Word.

The program's accuracy in recognizing individual words and numbers was strong, even though it fell short of perfection. With a small 13-row-by-8-column spreadsheet using hard-to-recognize 8-point text, TextBridge made 11 recognition errors. But it was completely accurate with numbers. Four of the errors involved adding characters to cells in which no characters belonged.

TextBridge was much more accurate with larger text in other test documents, sometimes achieving 100 percent word-recognition accuracy in cleanly printed documents. Even when it correctly translated all words, though, it sometimes made random but minor formatting errors such as boldfacing text that wasn't boldfaced in the source document.

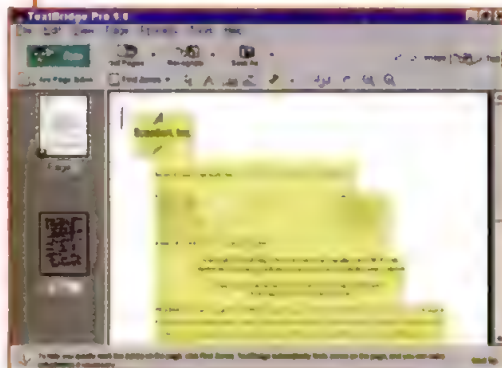
TextBridge 9.0's most pronounced improvement is its interface. Previously, the program's spartan interface had few toolbar buttons and confus-

ing menus that made it difficult to figure out how to perform some tasks. The new interface has large buttons for initiating the scan and recognition processes and saving the file, plus a button to do all three automatically.

Among the new features in this upgrade are the ability to convert recognized pages into HTML documents and a long-overdue scheduler for performing OCR when you're away from your computer. In addition, TextBridge can now recognize 56 languages, four times as many as the previous version could. Still missing is support for higher-capacity ISIS scanners.

This upgrade of Text Bridge Pro makes an already formidable product even more accurate and easy to use.

TextBridge Pro 9.0 List price: \$99. Requires: 24MB RAM, 20MB hard disk space, Windows 95 or higher, Twain scanner. ScanSoft Inc., Peabody, MA; 800-432-9329; www.scansoft.com.



▲ **NEAT GUI:** ScanSoft finally replaced TextBridge's overly spare interface with one containing clearly marked buttons for common tasks and well-organized menus.



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New Multifunctionals

The Compaq A900 All-In-One and HP OfficeJet R60 raise the bar for these versatile devices.

By Bruce and Marge Brown

New ink jet multifunction devices from Compaq Computer Corp. and Hewlett-Packard Co. tout advances in speed, quality, and ease of use. The Compaq A900 All-In-One (\$400 street) and HP OfficeJet R60 (\$700 street) are economical, space-saving SOHO solutions. Although they can't escape the category's major downside—if one feature breaks down, you're out of luck for all functions without backup devices—multifunction units in general have proved to be reliable.

The less expensive and more compact A900 can print, fax, copy, and scan: tasks made more convenient if you use the clever Control Forms technology. The R60 doesn't include faxing but has both page-feed and flatbed scanning and copying (the Compaq has page-feed only), is significantly faster in printing text, and does a much better job at printing photographic images.

COMPAQ A900 ALL-IN-ONE

The A900 is a color printer, copier, scanner, and two-way fax machine with three operation modes: Computer, Control Panel, and A900 Control Form. The unit is 9 by 17.25 by 22 inches (HWD) and looks like a conventional printer with extra input and output trays. The input tray holds up to 100 sheets of paper for printing, and the sheet feeder holds 30 pages for scanning, copying, and faxing.

The A900 requires a parallel connection to a powered computer for all printing, scanning, color

copying, and direct faxing of computer files, and when using Control Form. It runs as a stand-alone device for faxing and monochrome copying. The innovative Control Form cover-sheet technology, on which you complete instructions using checked boxes, is a time-saver for reused fax, copy, and scanner settings and frequently used fax distribution lists.

With print resolution up to 1,200 dpi, the device is rated to print at 8 ppm in black and 4 ppm in color. In testing, a single-page Microsoft Word document took 53 seconds, a 43-page mixed text and graphics document took 29 minutes 12 seconds (both at 600 dpi on plain paper), and a 5-by-7 photograph printed at 1,200 dpi on glossy photo paper took 3 minutes 34 seconds. Text output quality is comparable to that of most ink jet printers, but gray-scale and color photographic samples had minor banding.

You can make up to 99 copies with adjustments for enlarging, reducing, collating, and contrast. Faxing with the A900 is first-rate, with selectable confirmation reports, activity logs, and broadcast

▼ TAKE CONTROL:

Send a fax to multiple recipients simultaneously with Compaq Control Form technology.



faxing. Copy speed is rated at 4 cpm (copies per minute) for black and 1.5 mpp (minutes per page) for color. Color and black and white test samples scanned with no problems.

If you don't need the highest color-printing quality,

are the 100-page printer input tray and 50-sheet output tray.

The R60 excels in color printing, and black-text prints are sharp. Rated speeds for printing and copying are 11 ppm for black and 8.5 ppm for color. The R60



◀ **SCANNING WITH THE HP R60:** The flatbed design lets you scan almost anything, including 3-D objects.

printed text samples about twice as quickly as the A900 did: 11 minutes and 40 seconds for a 43-page mixed text and graphics document and 27 seconds for a

single page of text. Color printing was slower; a 5- by 7-inch, 600-dpi photographic image took 4 minutes and 36 seconds.

You can use the R60's copy function without a computer connection for monochrome and color copying. Clearly marked buttons set quality, paper type, contrast, color intensity, number of copies (like the A900, up to 99), and reduction and enlargement. The copy function worked smoothly in testing.

HP OFFICEJET R60

The HP OfficeJet R60—a color copier, printer, and scanner for SOHO and corporate professionals—is the midrange product in the HP OfficeJet R Series. The R60 produces near-original color copies and high-quality color prints.

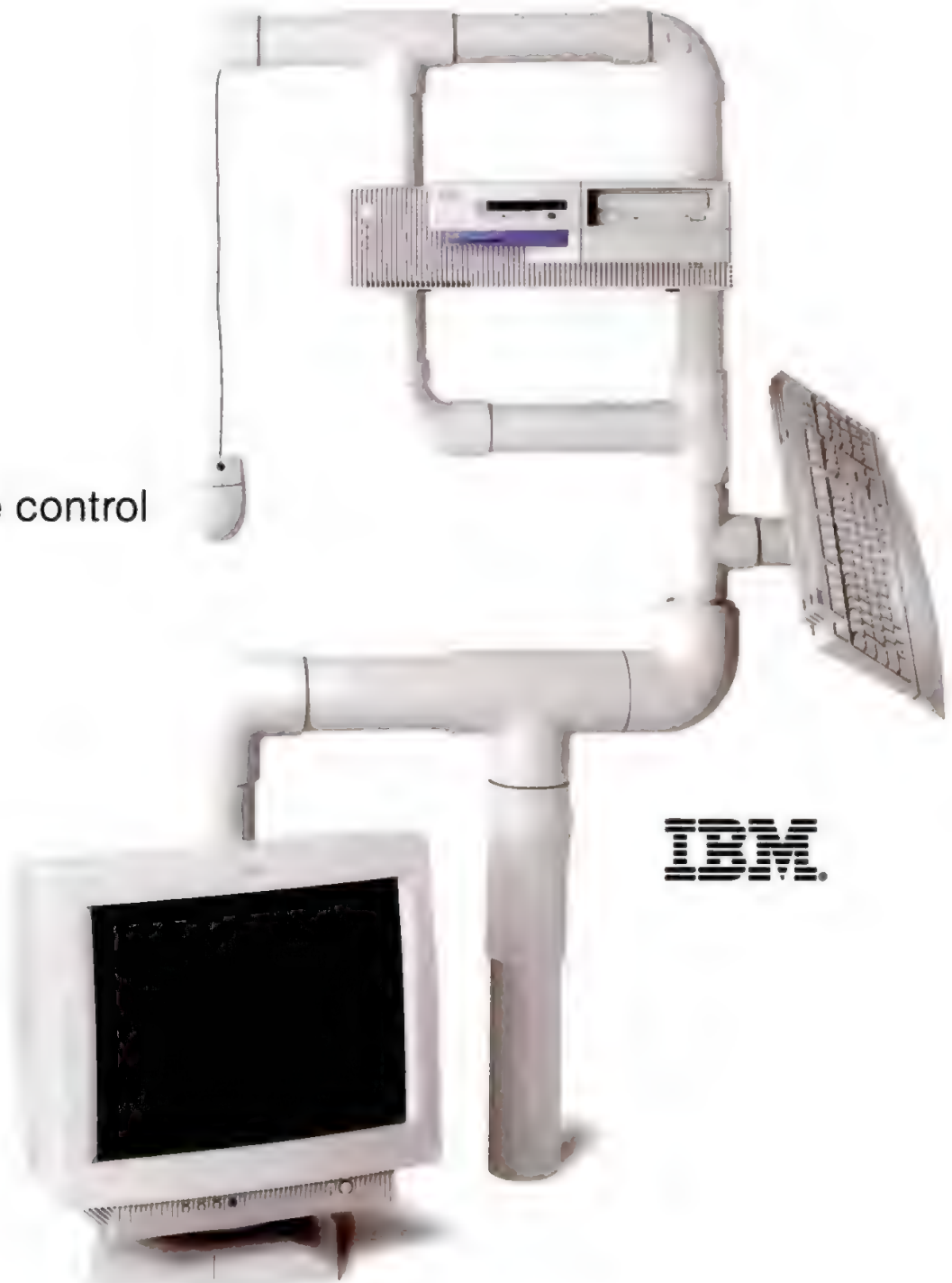
Tall and wide, the R60 measures 19.75 by 18.25 by 24.25 inches (HWD).

The top-mounted flatbed holds copy and scanner originals up to 8.5 by 11 inches; it can even scan 3-D objects. Input and output trays for the 30-page automatic document feeder are behind the flatbed. At the front base

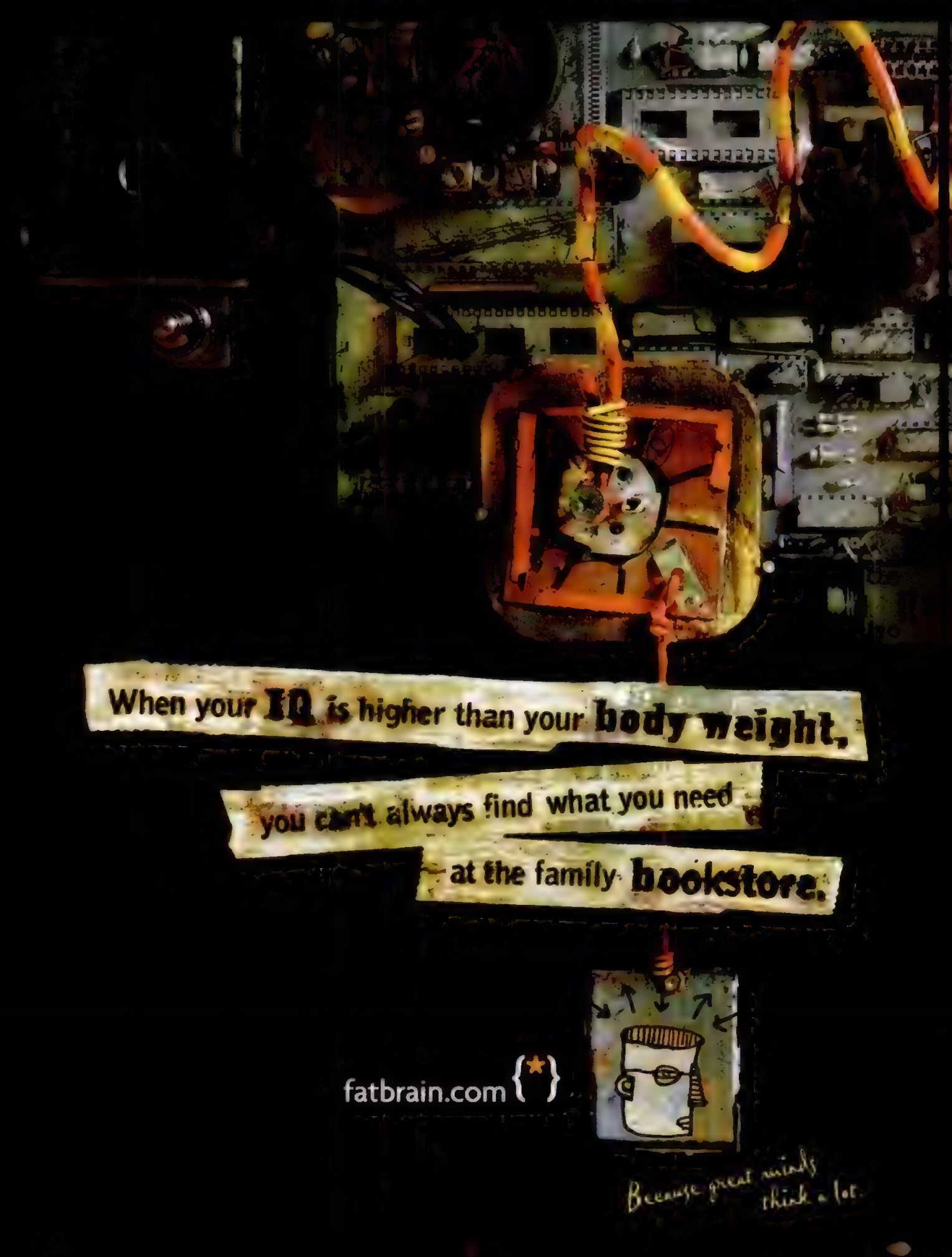
and you are prepared to manage a comprehensive device, take a look at the Compaq A900 All-In-One.

Compaq A900 All-In-One. Street price: \$400. Requires: 24MB RAM, 125MB hard disk space, Windows 95 or 98. Compaq Computer Corp., Houston; 800-888-0220; www.compaq.com.

HP OfficeJet R60. Street price: \$700. Requires: 32MB RAM; 70MB hard disk space; Windows 95, 98, or NT 4.0 with SP3 or higher. Hewlett-Packard Co., Palo Alto, CA; 800-752-0900; www.hp.com/go/all-in-one.

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Better 3-D on the Web

Cult3D from Cycore Computer delivers fast, browser-based 3-D—for a price.

By Edward Mendelson

Most 3-D images viewed in a Web browser suffer from limited detail and clumsy animation. Cycore Computer's Cult3D displays 3-D animations and manipulable objects in a browser window with the speed and detail normally possible only with hardware-accelerated video cards and games and specialized graphic applications. Unlike all other current 3-D Internet video, Cult3D uses proprietary technologies instead of the public VRML standard or any common Web-based standard, and it supports almost all the advanced rendering modes and textures found in high-end 3-D applications.

This speed and power comes at a price: Each Web site containing a Cult3D objects pays a one-time license fee of \$3,600 that covers the entire site, no matter how many objects are included. The browser plug-in that views Cult3D objects and the applications that create the objects are free downloads. The Cult3D plug-in installs itself in Internet Explorer as an ActiveX control. Netscape Navigator users have to download and install the plug-in by hand.

Webmasters who want to use Cult3D objects start by creating an object or animation in Kinetix's 3D Studio MAX, then export it, using an exporter module supplied free by Cult3D. An exported object can be placed directly on a Web page by adapting sample HTML code printed in the user manual. A separate, free application called Cult3D Designer applies animation and manipulation effects to Cult3D objects and exports a complete animation as a single Cult3D object. This can be placed on a Web page using the same code used to insert an object exported di-

rectly from 3D Studio Max.

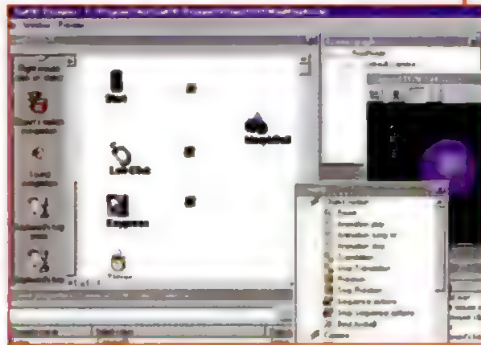
Cult3D Designer is a highly graphic, object-oriented development environment in which you can create traditional timeline animations or interactive animations or a combination of the two. By dragging and dropping events and actions into an event map window, you can easily assign actions to events such as the initial display of an object, a mouse click, a key press, or a timer.

Actions can make an object rotate automatically, turn in response to mouse movements, or

► **STYLIN':** Cult3D Designer's object-oriented environment uses drag-and-drop for basic actions and dialog boxes for fine-tuning events.

appear or disappear with a mouse click or key press, or they can launch an Internet address in the browser. If the original 3D Studio MAX object is complex enough, you can program elaborate animation effects such as opening and closing a car door.

For corporate Web sites that want to give visitors 3-D views of complex products, Cult3D has no competition. But you



might keep an eye out for low-priced competition to follow. **Cult3D.** License fee per Web site: \$3,600 direct. Requires: 2MB hard disk space, Windows 95 or later, 3D Studio MAX. Cycore Computers, Uppsala, Sweden; (+46) 18 656560; www.cult3d.com.

Online Career Guidance

CareerSteps helps corporations keep their employees challenged and satisfied.

By Carol A. Mangis

Considering the costs of recruitment and training, businesses have strong motivation to retain workers. CareerSteps, Web-based software and services from MindSteps (\$150 per year for an individual user; corporate price ranges from \$50 to \$150 per person), can help.

CareerSteps is a self-directed assessment program that can take the burden off managers who aren't as skilled at evaluating and mentoring their employees as they could be. And employees

can find out what they need to be happier and more productive.

The product is made up of three modules: Assessment (determining your interests and skills), Focus (finding your patterns and priorities), and Action (developing a plan of action). Originally, CareerSteps was marketed only to large corporations that customized and implemented it as part of their human-resources toolkits. Now, individuals can go to MindSteps' Web site and use the same service.

When a company contracts with MindSteps, the two develop

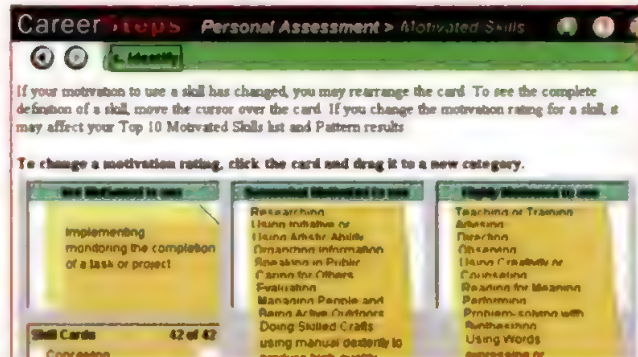
a customized intranet site. For example, an employee who shows a strong alignment with the Leadership and Creative patterns will be shown jobs within the company that match these patterns.

We tried CareerSteps from an individual's standpoint. The interface is well thought-out and fun to use. When selecting interests, for example, you are encouraged to go quickly. "Cards" appear on the screen, each listing an interest; you click on one of three ratings and the card is instantly "stacked" in that area. In areas where more thought should be given to answers, you must drag and drop the cards.

After you complete each section, the software analyzes the data and displays the results, then shows you how to use the information. Your data is stored at the Web site; you can print it out, and you can go back whenever you wish to adapt your profile.

For companies and individuals, CareerSteps can be a valuable tool for increasing employee job satisfaction.

CareerSteps. Price: Individual user, \$150 per year; corporate price ranges from \$50 to \$150 per person. MindSteps, Palo Alto, CA; 650-473-4837; www.mindsteps.com.



▲ **DEAL 'EM:** In CareerStep's highly interactive, Java-fueled interface, you stack "cards" to discover your patterns and priorities.



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Effortless Distribution

PictureTaker Express 2.0 makes it easy to distribute software and make changes to your client PCs.

By Les Freed

LANovation's PictureTaker Express 2.0 (\$895 list) is an innovative software product that makes it easy to distribute everything from single desktop shortcuts to a complete office suite. PictureTaker Express lets administrators and users create self-installing files bound for any Windows 95, 98, or NT PC with no additional client software.

Creating a distribution package requires three steps, and a wizard walks you through each one. First, start PictureTaker Express and let it make a record of all the files and registry entries on your computer. Second, pause PictureTaker Express and install the target software

on your PC. You may reboot the PC between steps, if necessary, and PictureTaker Express will pick up where it left off.

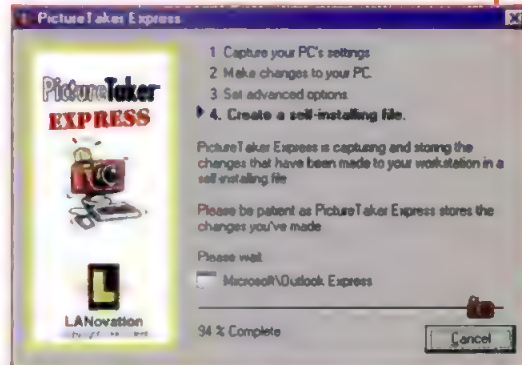
Finally, restart PictureTaker Express and the program automatically generates a self-installing file that incorporates all the changes you made to your PC. You can then run the self-installing file on any other PC and it will duplicate the changes you just made to the original PC.

Although PictureTaker's obvious use is as a software distribution tool, the self-installing files can contain any kind of change you want to make to another PC. You can manually edit the self-installing files to add checks for operating system types, sufficient disk space, or the presence

of a specific file or registry key before the self-installing file will run. You can also instruct the self-installing file to instruct the target PCs to reboot after the installation is complete.

We put PictureTaker Express through the wringer, adding and deleting software on several PCs on our network. In each case, PictureTaker Express faithfully reproduced the changes we made on each of the target PCs, even when the source and target PCs were running different versions of Windows.

Both network administrators and everyday employees within



▲ **GO ANYWHERE:** Self-installing files can be distributed via any medium.

small companies who act as network administrators will enjoy the usability and competence of PictureTaker Express. LANovation offers a free 30-day trial version of PictureTaker Express on its Web site.

PictureTaker Express 2.0. List price: \$895. LANovation, Minneapolis; 888-742-8253; www.lanovation.com.

Big Features Go SOHO

Routing, VPN, and PBX come to the small office via the Pivotal Networking StarGazer 1800.

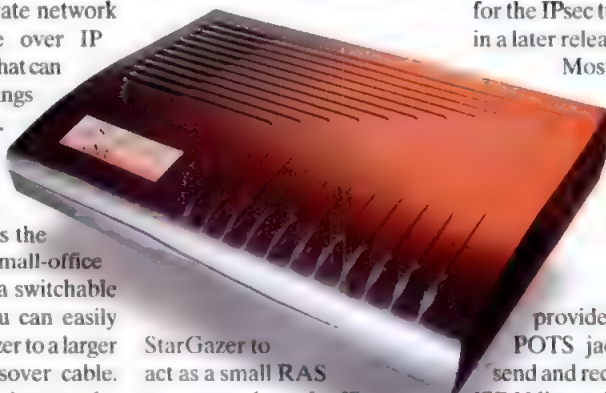
By Les Freed

The new StarGazer 1800 ISDN router (\$895 list) from Pivotal Networking isn't just another small-office router. This small box includes built-in virtual private network (VPN) and Voice over IP (VoIP) capabilities that can add up to big savings over its competitors.

The StarGazer has a built-in four-port 10Base-T hub, so you can use it as the main hub for a small-office LAN. One port is a switchable uplink port, so you can easily connect the StarGazer to a larger hub, without a crossover cable.

Initial configuration can be performed with any browser-equipped PC, using the built-in configuration server. The StarGazer's Web interface provides several levels of complexity, but most users will need to enter

only the most basic information (ISDN line information, ISP phone number, and ISP account name and password) to get connected to the Internet. Additional menus let you configure the



StarGazer to act as a small RAS server or a branch office IP/IPX router. A command-line interface is also available. The StarGazer can use name address translation (NAT) to provide Internet access to the entire LAN using a single, dynamically as-

signed IP address.

The StarGazer's VPN feature provides a secure tunnel connection between two StarGazers connected over the public Internet. The VPN tunnel requires that both StarGazers have permanently assigned IP addresses, and uses the L2TP tunneling protocol. Pivotal Networking plans to add support for the IPsec tunneling protocol in a later release.

Most ISDN routers

◀ **EASY ACCESS:** Configure the StarGazer via the Web or from a command-line interface.

provide one or two RJ-11 POTS jacks that let you send and receive calls over the ISDN line using ordinary analog phones. The StarGazer provides a third POTS jack and built-in VoIP capabilities that effectively turn the StarGazer into a three-line PBX system. Each of the three POTS jacks can be

used to call one another, or they can be used to place and receive calls via the ISDN line or over the Internet, using VoIP to connect to another StarGazer.

A built-in speed-dial table lets you assign two- or three-digit codes to remote phone numbers. If a user attempts to place a VoIP call to another StarGazer that isn't currently connected to the Internet, the originating StarGazer uses a unique feature called StarTouch to place a short, no-charge ISDN call to the remote StarGazer, instructing it to go online and connect to the Internet. If the remote unit fails to respond within a few seconds, the originating StarGazer can place the call via the ISDN line.

At \$895, the StarGazer costs nearly twice as much as the competitors' offerings, but its ease of use and sophisticated features may make the StarGazer worth the additional costs.

StarGazer 1800 Router. List price (including VPN and VoIP features): \$895. Pivotal Networking Inc., Sunnyvale, CA; 877-467-4868; www.pivnet.com.

Phones as Network Nodes

The 3Com NBX 100 Communications System sets a new standard in LAN telephony.

By Steve Rigney

Almost everyone has heard about gateway devices that allow you to make free long-distance calls over the Internet. There is also a new generation of products that allow you to make internal and external calls over your LAN. These LAN PBXs use the same cabling and infrastructure as your PCs, and provide most of the calling features you'll find in a traditional proprietary PBX. Furthermore, because they run over an Ethernet LAN, with more available bandwidth than a typical Internet connection, the voice quality is comparable to that of a traditional PBX and the public switched telephone network (PSTN).

The 3Com NBX 100 Communications System is just one of the LAN PBXs on the market. But with a turnkey installation, H.323 compliance, browser-based management, dual-port phones, and IP On-the-Fly, it is one of the best.

The NBX 100's price is very competitive with traditional PBXs and other LAN PBX solutions. We tested a small, \$3,500 (list) setup with 3 phones, 4 trunk lines, and an 8-port hub. You can purchase solutions as expensive as \$14,000—the high-end alternative includes 20 phones, 8 trunk lines, a 24-port hub, 6 auto-attendants, and 20 hours of voice mail time.

SYSTEM STATS

The NBX 100 system consists of a six-slot, 19-inch, rack-mountable chassis. Each chassis slot is populated with an NBX 100 Network Call Processor, a four-port line card, and an eight-port Hub card. Each chassis can hold up to 20 trunk lines, using five four-port line adapters. You can stack up to five chassis together

for a total of 100 incoming voice lines. The call processor is the heart of the system and performs all of the call setup and teardown, voice mail, auto-attendant, call traffic, and computer telephony functions.

Like a traditional PBX, the NBX 100 has ports for incoming PSTN trunk lines and ports for outgoing phone sets. But the outgoing ports are standard 10Base-T Ethernet ports. They can use the built-in hub, an external hub, or an external switch via the NBX 100's up-link ports. When a user places a call, the call processor determines whether it is an internal or external call. If internal, the call processor stays on the LAN and doesn't require a trunk line. If the call is destined for a remote user, the call processor transfers it to the first available PSTN line.

SIMPLE SETUP

We found the unit a breeze to set up. The call processor is preconfigured with an internal IP ad-

dress. All we had to do was connect a client PC to the hub card, change our PC's IP address to match the internal subnet of the NBX 100, and use a browser to access the NetSet setup utility, running on an embedded Web server in the LAN PBX.

We were able to change the IP address, provide phone extensions for all of the phone sets, set up voice mail, and assign user privileges easily. Individual users can connect to the NBX 100 via a browser and change basic settings, such as their personal auto attendant.

PHONE FEATURES

The phone sets look as nice and are as feature-rich as any you would get with a traditional PBX. Complete with an LCD, each phone has 12 programmable buttons, volume control, speakerphone, mute, mail forwarding, hold, conference, call transfer, and redial. There are also programmable feature buttons for transferring voice mail, call parking, and extension page. The phone sets work with outside telco features, such as caller ID and call waiting. All of the features are easy to program, and the manual does a good job of

explaining each step.

Each phone set also has two 10Base-T ports and works as a two-port hub. One port connects the phone to the Ethernet wall jack and the other uses a patch cable to attach the client PC. This lets you share one cable drop with both the Ethernet phone and the client PC. Note that you don't have to have a client PC at each location you place a phone.

Our favorite feature of the NBX 100 phones is their ability to act as an Ethernet OSI Layer 2 or an IP OSI Layer 3 device. Other products, such as the Cisco IP Phone, can only work as an IP device on the LAN. While this is fine for small networks, requiring a separate IP address for all of your phone and network nodes can deplete your available addresses in a hurry.

The NBX 100's IP On-the-Fly lets the phones use Ethernet frames as long as they are communicating with other phones on the same subnet. If the user makes a call to another user on a separate subnet, the phone will automatically retrieve an IP address from a pool specified by the administrator. When the call is terminated, the IP address is placed back in the pool.

The New NBX 100 vs. a Traditional PBX

	3Com NBX 100 Communications System	Traditional PBX
Scalability	148 devices (combination of lines and phones up to a limit of 100 lines)	Thousands of phones, hundreds of lines
Interoperability	H.323-compliant	Proprietary
Communication between remote phone systems	None	Signaling system 7
Voice quality	Based on LAN QoS	Toll voice quality
Cabling	Category 3 or higher UTP	Standard voice-grade wiring
Cable length	100 meters	1–2 kilometers
Powered phones	AC adapter on each phone	Nonpower phone sets
Telco services (such as call waiting)	Fewer than 50	500 or more
Redundant hardware	None	Power supplies, voice cards
Calling feature interface	Windows GUI	Phone set
Ease of use	High	Low
Cost per phone	\$349 list	Approximately \$100
Security of voice conversation	Requires LAN encryption	Secure because of separate infrastructure
Management	Browser-based	Windows- or character-based utility
TAPI	Yes	Usually requires a separate box

► PHONE ALTERNATIVES

The NBX 100 offers more features and less fuss than many traditional PBX solutions.

VOICE NEEDS TOP PRIORITY

Unlike data packets, voice packets can't handle long delays or dropped information. Therefore, there needs to be some kind of Quality of Service (QoS) mechanism on the LAN to make sure that voice packets get top priority to and from their destination. The NBX 100 relies on both the IEEE 802.1Q and P standards for this. The Q standard is for creating a local



bridge on a LAN via layer 2 Ethernet frames. The P standard is for local as well as metropolitan area networks.

The NBX 100 also supports the QoS standard known as IP Precedence or IP Type of Service (TOS). TOS allows the existing switches and routers to treat

packets differently based on their content. For example, by setting the TOS bit on an IP voice packet, routers will know to give those packets priority over standard data packets. The call processor also supports the H.323 standard for compressing voice into data packets and interoperating with other H.323 devices.

BEATING BANDWIDTH

Although most small LANs have enough bandwidth to carry relatively small, 64-Kbps voice calls, a congested LAN will affect the quality of the call. Administrators should monitor the LAN bandwidth and take mea-

sures, such as installing switches or routers, to get normal data traffic down to around 50 percent of available bandwidth. Anything higher will affect the quality of both internal and external LAN PBX calls.

If you have an existing traditional PBX and it provides all of the features you need, there is no need to upgrade to a LAN PBX. But the NBX 100 is a solid solution for small to medium-size organizations that don't have a PBX of any kind, are not happy with their current solution, or don't get the features they need from phone company services.

NBX 100 Communications System. List price, as tested: \$3,500. 3Com/NBX Corp., Andover, MA; 978-749-0000; www.nbxcorp.com.

Snuff Out Surfing

SuperScout 2.5 helps you establish and enforce a reasonable corporate Internet policy.

By Greg Alwang

SurfControl's SuperScout 2.5 is a business-class Internet-monitoring and -filtering tool that lets you determine what users can access rather than what they cannot. SuperScout 2.5 (100 users, \$2,000 list) is extremely easy to use, yet it offers the flexibility to establish and enforce corporate Internet access policies. Most important, SuperScout's unique filtering lets administrators get a handle on Internet use and misuse without incurring a load on the network.

SuperScout runs on Windows NT 4.0 Server or Workstation and sniffs network packets using pass-by filtering (as opposed to the more common pass-through filtering). This results in little or no measurable impact on network performance and makes SuperScout both highly efficient and scalable to large environments.

The Rules Administrator lets you drag and drop objects to de-

fine which users the rule affects, where the affected users can or cannot go, and when the rule is in effect. You can easily build custom Internet access control lists using existing sites, domains, or the SmartScan feature, which searches for keywords as sites are accessed. Both NetWare and Windows NT users and group objects can be included in each Rule. You can even specify which Internet protocols to allow or disallow.

Rather than focusing solely on negative content, SuperScout relies on a combination of positive, general, and negative filtering. With positive filtering, SuperScout draws upon an extensive list (called Web4Business) of over 500,000 business Web sites categorized into Standard Industry Sector Codes (SICs). Using a SIC code, SuperScout can rate the business relevance of each site based on your business policies.

For general site-filtering, SuperScout recognizes over

150,000 General Access sites covering topics such as sports, news and entertainment. In case you need to filter negative or undesirable content, SuperScout is planning to integrate negative Web site lists later this

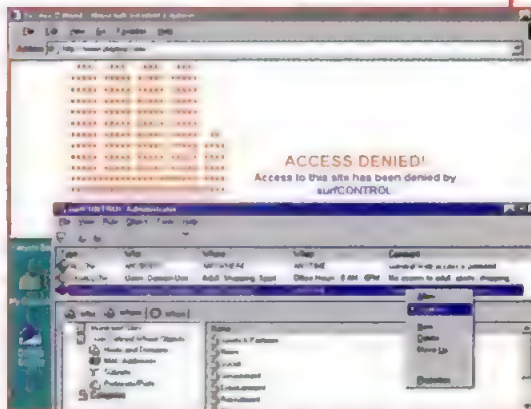
► RULES ADMINISTRATOR:

You can easily configure the Who, Where, and When components of your Internet access policy by dragging and dropping criteria objects into Rules.

summer. Until then, you can manually enter sites or keywords to block.

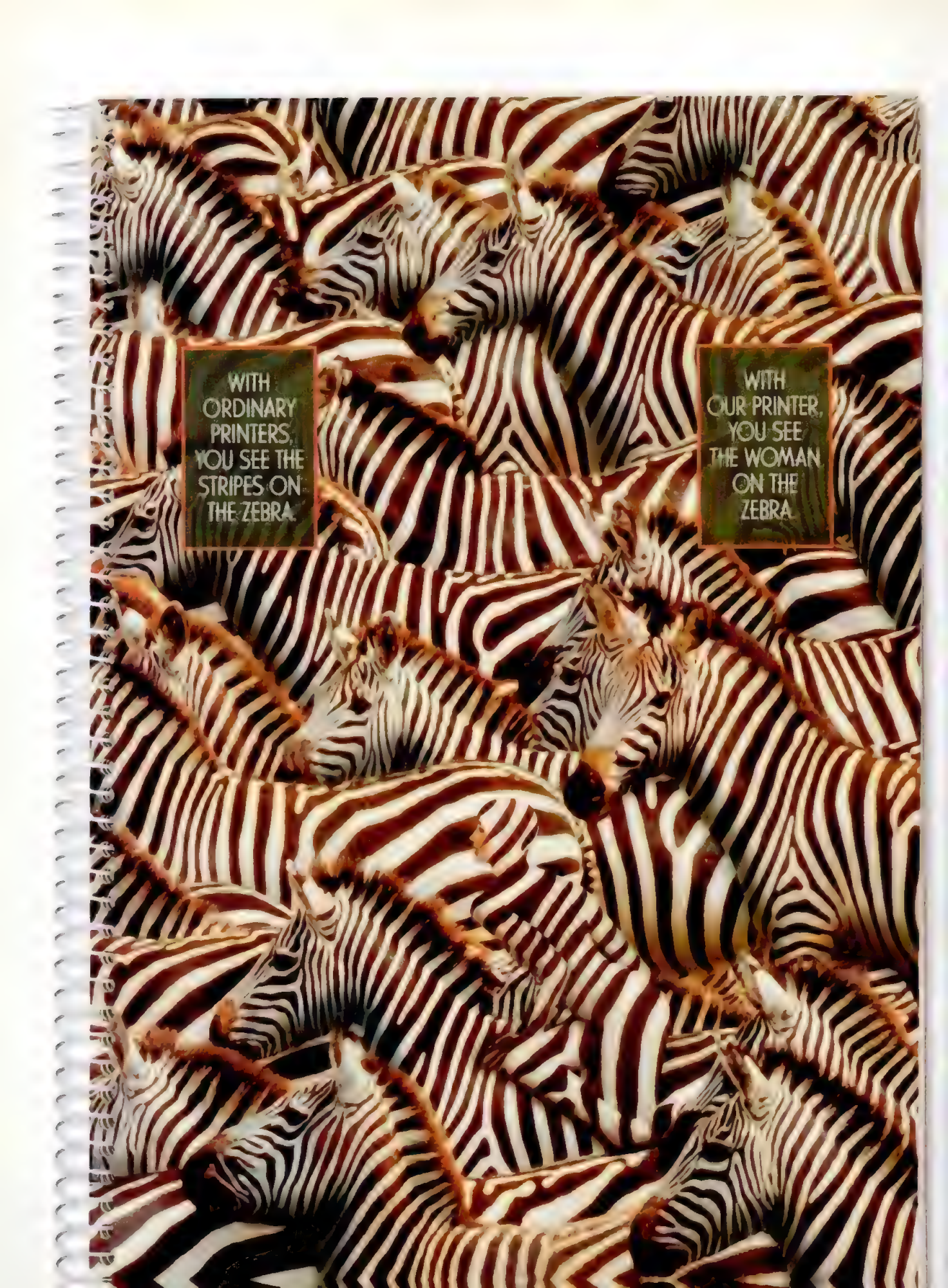
SuperScout's open-ended design lets you apply categorized site lists (for example, General Access or Web4Business) in your filtering process, letting you create custom access control lists. Once a Category List is added to SuperScout, you simply drag and drop the list object into a Rule to activate its categories.

The SuperScout Monitor lets you view online activity and run various reports against usage data. The "live" Sites and Users windows let you quickly see which users generate the most traffic and which Web



sites are the most popular. Dozens of summary, comparison, and detail reports are available, such as Top 10 Sites, Departmental Comparison, and even Browse Time Activity which shows the duration of browsing sessions.

SuperScout 2.5. List price: up to 100 users, \$2,000. SurfControl, JSB Corp, Scotts Valley, CA; 831-438-8300; www.surfcontrol.com.

A dense crowd of zebras is shown from a high angle. The zebras are packed closely together, their heads and necks visible. The stripes are a mix of black and brown on a white background. In the center-right of the image, a woman's face is superimposed onto a zebra's head, making it difficult to distinguish from the others. Two text boxes are overlaid on the image, one on the left and one on the right, both with a dark green background and white text. The left box contains the text 'WITH ORDINARY PRINTERS, YOU SEE THE STRIPES ON THE ZEBRA.' and the right box contains the text 'WITH OUR PRINTER, YOU SEE THE WOMAN ON THE ZEBRA.'

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IE5 Makes the Cut

By Jim Lynch

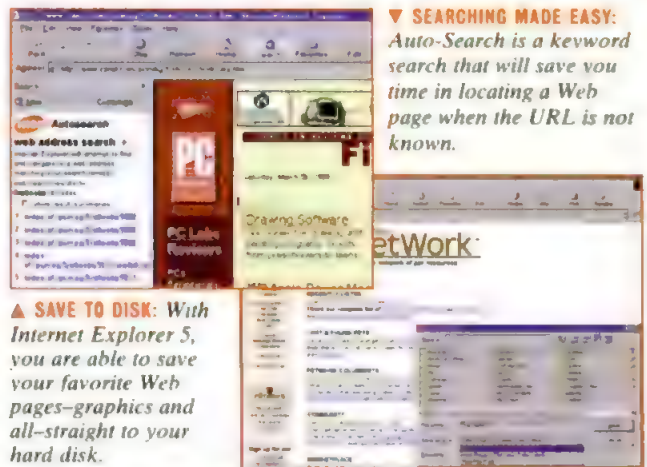
New versions of browsers tend to bring out the best or the worst in people. Those who experience a flawless installation and a bump up in performance or features usually gush about how great their new software is. Those whose systems get wiped or who have post-installation crashes curse the vendor's name and vow never to install an initial release again.

Our own experiences with Internet Explorer 5 have been quite positive ("IE5: The Final Cut," First Looks, April 20, 1999). Browser load time is down, pages load faster, and we aren't seeing the same stability problems we noticed with Internet Explorer 4. Not everyone has had the same experience, unfortunately. A few contributors to our Second Looks discussion have experienced system stability problems that left them disgusted with IE5. Those upgrading from IE4 weighed in with more positive feedback than those switching over from a Netscape browser.

One thing that has drawn

criticism from our readers is Microsoft's continuing attempt to integrate IE5 with its Windows OS. Most people are happy with IE's feature set, though, particularly with Outlook Express 5. This feature was one of the main reasons for people to download and install IE5 in the first place.

Additional features include a text highlighter, the ability to add wallpaper to IE5's interface, links and images lists, an image toggler (which tells the browser whether to load images), and the ability to zoom in and out of a graphic. There are two useful developer tools as well—one that lets developers easily view the partial source code of any



▲ **SAVE TO DISK:** With Internet Explorer 5, you are able to save your favorite Web pages—graphics and all—straight to your hard disk.

page and a Document Object Model tool that lets developers see all the DOM properties of a page in tree form.

So far all of these add-ons have worked very well for us.

▼ **SEARCHING MADE EASY:** Auto-Search is a keyword search that will save you time in locating a Web page when the URL is not known.

But with any free software, you should always operate under the principle of caveat emptor. You can download these extras at www.microsoft.com/windows/ie/webaccess/ie5tools.asp.

Ready, Set, AvantGo

By Josh Taylor

When we first reviewed AvantGo ("Software to Go," February 23, 1999), we focused on its potential appeal to corporate customers. While AvantGo still actively courts corporate clientele, it has taken a leap into the consumer market.

First, the company stopped charging for its software (except for corporations using custom-built apps). Then, AvantGo signed up big-time content partners, allowing users to get up-to-date news from The New York Times, the Industry Standard, The Wall Street Journal, and ZDNet onto their Palm devices via a simple—though not speedy—HotSync operation.

And recently, AvantGo introduced AvantGo.com (www.avantgo.com) and a new client, Version 3.0. The latest release adds support for Windows CE devices, along with support for HTML tables.

AvantGo also announced a host of new content partners, including TheStreet.com, The Weather Channel, the Real Cities network of city guides, and FOXsports.com. Several providers are also offering channels optimized for wireless connections, including delayed stock quotes from Bloomberg.com, hotel and restaurant directories from Fodor's Travel Online, and mapping from MapBlast!

Of course, the more features

you add, the bigger the footprint. Whereas AvantGo 1.0 took up a mere 130K, the latest release weighs in at approximately 210K.

The larger file size shouldn't prove much of a deterrent to users of Windows CE devices and Palm IIIx users. But those using Palms with 2MB or less of RAM (that includes the Palm V and Palm III) will want to be careful with adding channels.

There is some disagreement among readers whether the new version's pros outweigh the cons. "The new version seems like it should be great, until you realize the application [no longer] maintains and updates local HTML files," reader John Morrison said.

The latest release hasn't scared off everyone, though. "If the promise of added functionality comes through, this could be a great app for palm tops," wrote Paul Sumi.

Other complaints include AvantGo's inability to display pages larger than 32K and a lack of support for JavaScript. Most of you felt, however, that AvantGo greatly enhanced your hand-held's functionality.

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Tell us what you think...How do you like the new products you're using? Second Looks is your forum for feedback. Join us online to tell us about your experiences. We discuss a different new product each week and summarize your comments here. Following are some of your comments from our discussion of Internet Explorer 5.

I don't think it's the best browser available today. I don't want to install 50 new pieces into already bloated Windows. Add IE4 to Windows 95 and it slows down by an incredible amount, even when you're not using the browser. Getting around my hard disk at Internet speeds is not the kind of convergence of Web and desktop I thought Microsoft was talking about.

—Simone White

The seamless integration of IE5 into the Windows 98 platform makes it the obvious choice now. It makes a perfect desktop, with folders or favorites on the left and my favorite home page on the center and right side. The Full Screen feature alone makes it better to use than Netscape. This seamless integration is what Bill Gates envisioned with this browser, and Microsoft has succeeded beautifully.

—Jay

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56K modems are capable of 56Kbps downloads, however, current regulations limit download speed to 53Kbps.

Internet connectivity requires access services from an Internet access provider. Contact your local access provider for rates, terms and conditions.

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Who Is Aaron Blosser?

Aaron Blosser is the contract programmer and self-described “math geek” who last year harnessed over 2,500 U S West computers, installing a program that would utilize their idle time to find very large prime numbers. Their combined computational power in theory surpassed that of most supercomputers.

He used standard Windows NT Server commands and services to identify the other machines on the network and to distribute a program called NTPrime to them. He then used standard administration techniques to install and run NTPrime, which was set to run at a low priority so as not to interfere with foreground business activities. U S West, however, experienced response delays, called in an investigative team, and found NTPrime running.

I doubt that anyone will ever know whether the delays were caused by NTPrime gone awry or by a problem elsewhere on the network. But U S West called in the FBI, which obtained a search warrant for Blosser's home. The warrant is available online, and it's interesting to see the lengths to which U S West and the FBI go to paint Blosser as a dangerous hacker, possibly intent on deleting customer records and crashing central offices, rather than as a mild-mannered mathematician in search of prime numbers, seduced by the billions of unused CPU cycles around him. The warrant includes quotes that paint Blosser as a computer genius who could bend the entire U S West intranet to his will, when his primary crime seems to have been a thorough knowledge of Windows NT Server console commands. They even put a price tag on the otherwise-unused CPU cycles.

In the long run, U S West declined to bring charges against him, but the FBI confiscated Blosser's computers. The general press got it wrong and mostly bought into U S West's portrayal of Blosser as a hacker. Everything's back on an even keel now, but Blosser ruefully suggests that anyone looking to do something with unused computer cycles on machines that are not their own ask permission first.

If you'd like to make a charitable donation of CPU cycles to a higher purpose, there has never been a better time—if you get permission, of course. The Great Internet Mersenne Prime Search (GIMPS) is under way and finding new primes. Mersenne numbers have the form $2^p - 1$, where p is a prime number, but a prime exponent doesn't guarantee that the Mersenne number itself is prime. Mathematicians have a fasci-

nation for the unique properties of Mersenne primes. You can get more information at www.mersenne.org.

The Search for Extraterrestrial Intelligence (SETI) has been running for years on some of the world's largest radio telescopes. The problem is there's too much data and too few supercomputers to analyze it properly. Seti@home is a new venture that looks like a screen saver but actually requests raw radio-signal data from a central computer via your Internet connection. Instead of a star field or flying Microsoft logos, you see a visual representation of your machine sifting through radio emissions that originated many light-years from here as it looks for coherent, nonrandom signals. The program stops processing whenever you want to use your computer. SETI hopes to have 100,000 or more computers working on the problem. You can download seti@home from ZDNet's Software Library.

By the way, SETI and those signals figure heavily in one of the best novels I've read recently: *The Sparrow*, by Mary Doria Russell. It's a fascinating, sometimes painful inquiry into humankind's role in the universe and the often-unintended consequences of our actions. Highly recommended.

Then there's distributed.net (www.distributed.net), which bills itself as “the world's fastest supercomputer.” This site is another effort to use idle CPU time to solve other mathematical problems, such as proving the robustness (or lack thereof) of encryption algorithms.

Will programs that commandeer your system's idle time hijack your data or allow viruses into your system? Unlikely. The projects I've mentioned are run by responsible research organizations or universities. Of course, you wouldn't give access to your computer to everyone who comes knocking; it pays to investigate.

The communities that spring up around these efforts are interesting too. Check out www.amsci.org/amsci/issues/comsci98/compsci1998-03.html. Maybe you'll be part of something really big, like discovering the first million-digit prime number. **PC**



If you'd like to make a charitable donation of CPU cycles, there has never been a better time.

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Telecomputing's Wrong Turn

The biggest buzz in the industry is over *nouveau* phones that act as little Web browsers, organizers, calendars and—uh—phones. Over the years, I've been promoting the be-all, end-all PDA that has phone functionality. These new phones are similar but wrongheaded. The all-in-one device of the future

should be computer-centric, *not* phone-centric.

As a reminder, the all-purpose, futuristic PDA I've been talking about is a device about the size of a 3Com Palm III. It would house a complete computer system, TV, radio, phone, voice recorder with recognition, GPS, radio Internet connection, and LoJack device (since it would inevitably be lost or stolen).

The device would drop into a cradle that would be nothing more than a port replicator that hooks up to a keyboard and monitor for normal desktop use. All the functionality, including mass storage, would be within the device. In portable mode, it would use a touch-sensitive screen and voice for command and control.

There's also no reason you couldn't plug in a pair of virtual-screen glasses, which Olympus and Sony are already showing behind closed doors. These glasses allow you to see a 60-inch virtual monitor. While you're looking at the virtual screen, the phone's screen can be used as a touch pad; you can scan through a complex database while on an airplane. It would be freaky to see a bunch of guys in business class wearing goggles, but expect it within the next decade. Moore's Law almost mandates such a thing to appear within the next 15 years.

Meanwhile, in their struggle to rule the world with portable phone technologies, Ericsson and Nokia are slipping these features into phones and hoping to steal the lead horse in a technology stampede.

But there's something about the phone business that prevents it from progressing at full tilt. Some say this is because Moore's Law will never apply to a backhoe or someone stringing cable on a pole. Why doesn't Moore's Law apply to cellular technology? It seems to, up to a point, but then it stops. The reason has to do with centralization—the old bugaboo of technological progress.

Remember that once computers got out of the hands of batch-processing types, things really took off. Moore's Law, which has transistor counts doubling every 18 months, made this happen, as it became possible for people to buy cheap computers. Things

moved at a rapid clip because of *personal* computing. If I wanted to buy a faster machine, there was nothing to stop me. If I wanted to program the thing, there was nobody to say I couldn't.

None of this is necessarily true with phone-related technologies. Users of these devices are still at the mercy of cellular connection providers and the government. The cell phone alone is useless without a cell. It's tethered much as computer terminals in the old days were tethered to the mainframe. End users have little control over their destiny under these circumstances. I don't see this changing without the laws governing true point-to-point communication changing.

In Taiwan, for example, you can buy a wireless phone similar to the 900-MHz cordless phones we use around our homes. But the Taiwanese phones can transmit 20 miles or more. Using spread spectrum and encryption, thousands of connections run simultaneously. Try bringing one of these into the United States and you'll discover that you might as well live in Saudi Arabia, where numerous technologies are banned to protect the state.

There's no reason technologies can't be developed that would let us use a combination of radio and IP to be our own phone companies. Why should these technologies be regulated at all? The excuse is for emergency services—universal 911. What nonsense. These services are relatively new and notoriously ineffective. Try using 911 in a mixed jurisdiction, for example. Anyway, I'm sure something could be developed to cover this "safety problem."

In case you haven't noticed, our government doesn't want us all doing our own thing when it comes to communications. Some people even want to ban all use of encryption. Let's not forget the Clipper Chip they wanted to put in all computers to keep us in line. So the likelihood of open voice communications is out; centralization is in. This means progress is stifled by the backhoe and Big Brother. Adopting a phone-centric track will do nothing but slow things down. Whom does that benefit?



There's no reason technologies can't be developed that would let us use a combination of radio and IP to be our own phone companies.

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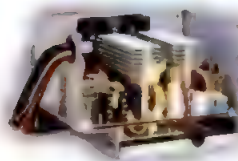
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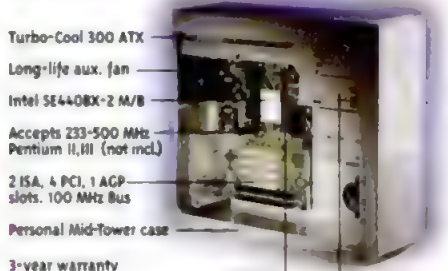
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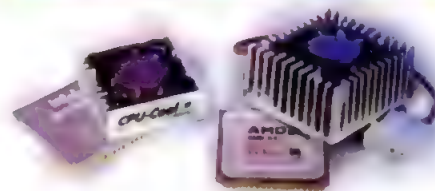
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John C. Dvorak's



INSIDE TRACK

As we kick into motherboards with 100-MHz bus speeds, look for **Taiwan to up the ante with a 133-MHz** bus speed with the release of numerous 133-MHz boards utilizing 133-MHz SDRAMs. Apparently it doesn't cost much more to do them. I recently put together a 100-MHz ASUS motherboard from Asustek in Taiwan (www.asus.com.tw) and found it an easy exercise. I'm advising people to consider some of these Taiwanese boards, because they're **inexpensive** and they seem more reliable than those found in many commercial systems. ASUS is at the top of its game, with what many consider to be the best-designed motherboards on the market today. Any shop that carries motherboards has these. ASUS is a company to watch.

An interesting aspect of all this is that I was under the impression a few years ago that **Rambus memory** would begin to dominate the scene about now. I haven't seen a system using it. Where is it?

And while on the subject of advancements in technology, since when did game consoles become state-of-the-art? First Sony announced a series of chips for its PlayStation II that were beyond what anyone has even dreamed of. Now **IBM does a deal with Nintendo** so Nintendo can use 0.18-micron PowerPC chips with the new copper process.

Most people who discuss gaming will tell you that the emphasis should be on the design of the games, not the raw power of the machines. I seldom play with game machines anymore because the games are too hard and **playable only by game addicts**, who move from one difficult game to the next. Game makers target the addicts, who get bored if the games are too easy. This tends to squeeze out the casual player. Eventually there will be nobody left and **the market will fold**—wishful thinking maybe.

Look for a **new fast chip** out of England from a company called PixelFusion. The Fuzion 150 will do **1.5 trillion operations per second** and will sell for \$1,000. The Web site at www.pixelfusion.com describes this chip as perfect for **next-generation 3-D computing**. The chip, which is a parallel processor, uses a technology called Single Instruction Multiple Data (SIMD). The company stemmed from Immos, a famous British semiconductor firm. Keep an eye on these guys.

Bill Is King Dept.: According to research done by Techtel Corp. out of Emeryville, California, any negative thoughts in the market that focus on Microsoft are generalized about the company as a whole, but any positive thoughts about the company seem to be directly linked to positive thoughts about Bill Gates. In a nutshell, this means the company would lose mind share (and serious valuation) if Gates were ever to quit Microsoft. More on this in future columns.

The Next Big Trend Dept.: Those of you who have been following Internet trends know that auction sites and the auction phenomenon are hot topics and that these sites are compelling. The lead site in this arena is eBay, which has managed to turn what could have been mere classified ads into **a real phenomenon**. In fact, when you talk to many merchandisers, the notion that all pricing of everything may turn into variable pricing is a realistic one.

Variable pricing—what the auction sites promote—turns stable markets into Middle Eastern bazaars where people **haggle over everything**. It's too competitive as far as I'm concerned. When you bring up the fact that many car sales operations have successfully turned to fixed pricing, variable-pricing advocates say it's because the car-buying experience has been traditionally **miserable**. But didn't it become miserable because of variable pricing?

Variable pricing is also a double-edged sword. With eBay, this is actually competitive buying. As with a real auction, where **an auctioneer taunts you**, you're competing with other buyers to get something. Observers now see a new idea beginning to emerge: reverse auctions. Sites like www.accompany.com **consolidate buyers** for specific products and create a competitive selling environment.

If I can get 1,000 people who want to buy ViewSonic flat panels, can I then go to ViewSonic and tell the company to lower the price? And if Nokia comes in with a cheaper price for essentially the same monitor, can I get ViewSonic to go lower? What if I tell all these vendors that I'm **upping the ante** to 1,500 units? Heck, let's say 5,000 units. What kind of a deal can I cut now?

Exactly how these deals can outdo the pricing Circuit City gets from long-term mass buying remains to be seen. But one thing is certain about variable pricing and competitive buying and selling: It's a **time killer**. The hours and hours spent combing eBay or fretting over saving a few bucks are not worthwhile if your time has any value. End of diatribe number 94,376.

Genuinely Interesting Software Dept.: For those of us with tens of thousands of files, the need for file management tools is never-ending. The functionality of DOS-based X-tree and Z-tree has never quite been duplicated in Windows—at least until now. A product from Clear & Simple called DiskJockey 98 manages to do the impossible and achieve this goal. I recommend that **Microsoft buy these guys out** and make DiskJockey the Windows file manager. It would save the world **a lot of grief**. With built-in Zip capability and over 200 file viewers that let you see everything fast, as well as easy-to-use organizational buttons, this product is super. Don't even think about it, just buy it. It's \$54.95 on the Web site (www.clearsimple.com). Or call 860-658-1204 and get a copy. Killer. 

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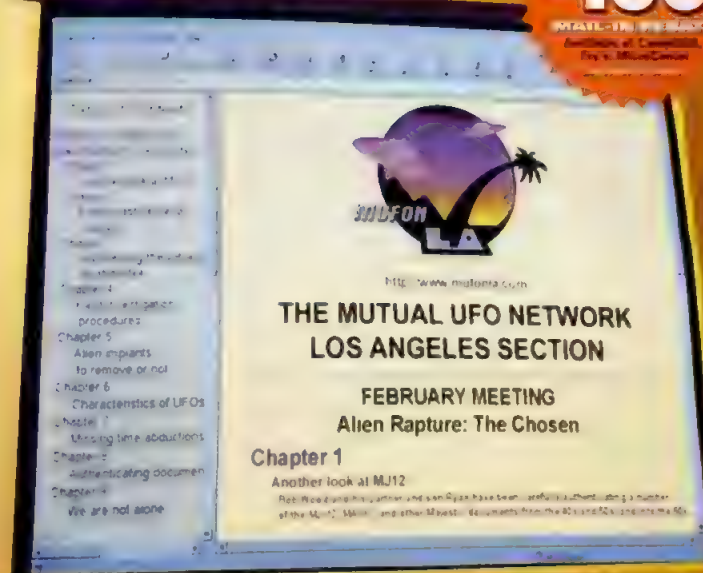
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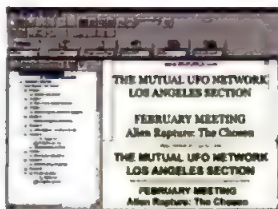
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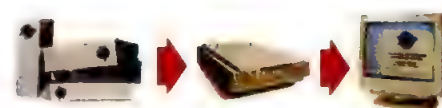
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Running Out of Pockets?

So just how much electronic junk are you willing to haul around? I see people with a cell phone in one hand, a pager on a belt, a PalmPilot stuck in a breast pocket, and a PC carrying case with (undoubtedly) a notebook inside. For all I know, there's a GPS receiver somewhere in there too. And

maybe a little Sony digital note taker.

That array of techno-geek—these days, should I say “business geek”?—regalia is becoming more and more burdensome and less and less necessary. This summer, we can start saying good-bye to at least some of the madness.

For many, the pager will be the first to go. In some ways, cell phones have already made pagers obsolete, though there are a few arguments to be made for the better alphanumeric pagers. The convenience of letting a few text messages pile up unread on your pager, then going through them and calling back only the people you really want to talk with, is considerable. (But what if you miss a critical message?) And although you can just ignore—or discreetly take a quick look at—an incoming message on a pager without ruining an important live conversation, people who answer incoming cellular calls while in conversations or meetings with others usually get the kinds of black looks they deserve.

But cell phones have begun to make pagers *passé*, since most of the newer digital phones also accept alphanumeric pager messages. (Agreed, they're not quite as convenient to carry, and text is harder to read on a cell phone's tiny display, but these are minor annoyances when the gain is cutting down the number of beeping gizmos you have to carry around.)

Better cell phones aren't going to kill off pagers, though. That credit will go to the new generations of wireless PDAs (personal digital assistants) that will begin appearing this summer. The ones we'll see this year are only about halfway there—just a glimmer of what's to come. But it is clear that they are on the high road, and pagers and cell phones—and for some, that notebook PC—may start staying home.

The key? Workable national wireless connectivity, which finally arrives this summer in a usable form with the new 3Com Palm VII. 3Com has linked up with the former Regional Bell Operating Company BellSouth to provide Palm.Net, a wireless service with paging, e-mail, and limited browsing of specially reformatted Web pages (see our First Looks re-

view of the Palm VII in the June 22 issue).

Because a PalmPilot can be, in effect, one very smart pager indeed—and it is, with only minor limitations, a two-way device, not a receive-only system—Palm VIIs ought to reduce many users' loads almost immediately. It isn't fun to write long outgoing messages on them, since you have to use either the built-in Graffiti “jotting” gesture-recognition technology or tap-tap-tap on the traditional Palm picture of a keyboard, but you can do it. (Of course, you don't *have* to respond via the wireless capabilities of your Palm VII; you can call your contact or simply ignore the message for a while, as many of us do now.)

The next big thing for PDAs is going to be cell phone functionality. We already have this in the Nokia 9000i Communicator phone, which includes PDA-like functions. But the Nokia 9000i is only an okay cell phone, and it's a distinctly marginal PDA. Too big, too heavy, and suffering from all the usual sins of first-to-market technology products, it has not been much of a success.

What we want is a thin device, maybe two-thirds of the volume and half the weight of the Nokia 9000i, for about \$750 to \$1,000 (which will fall sharply soon after its introduction, once early adopters like me have shelled out big bucks for the almost-there first iteration). Enter the Palm VII, which is *not* a cell phone but provides an implicit road map for handheld wireless devices to come.

Indeed, comparing the Nokia 9000i and the Palm VII is instructive, not only for the differences in form and function but also because the comparison highlights what may prove the major problem in choosing one of these wireless, multifunction, Swiss-Army-knife-like devices: Which compromises will you put up with? In which direction should designers tilt as they cheat a little on functions A and B to make functions C and D more robust?

Just like multipurpose pocket knives, multifunction wireless devices can do many things, but they rarely do any one as well as single-function, purpose-specific devices can. Sure, you can find a pocket knife



Techno-geek regalia is becoming more burdensome and less necessary, thanks to national wireless connectivity.

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with a fold out fork, but do you really want to eat very often with a fork from your pocket knife?

I think the PDA, pager, e-mail, cell phone, and (limited) Web-browsing features of successful wireless PDA gizmos must all function at a high level. I won't give up my beloved Nokia 6160 cell phone unless whatever replaces it is at least as good. I won't give up my favorite PDA (currently a Casio Cassiopeia) unless whatever replaces it is at least as good, and preferably better. And I won't give up my light, compact Motorola Advisor Elite pager until...well, you get the idea.

Beyond these five core functions, I'll put up with limited or skeletal implementations of other features. For example, I rely on my little Sony digital note taker. So I want a wireless PDA with decent or better voice recording, though *you* may not want voice recording at all. I use speakerphones constantly, so I want decent speakerphone capability in my dream wireless PDA; but speakerphone haters, or those who just don't see much purpose in them, won't care if that's not included in the model they choose.

The Palm VII and the other new wireless PDAs coming to market this year will all fall short of my ideal, and probably yours too. This doesn't mean they aren't worth having—I'm going to jump on one, just as soon as I figure *which* one—but it does mean we should see these as pointers, indicators of where this market is going, and not as a reflection of everything these little gems will be able to do soon enough.

Well, not "soon enough" (*I want my MTV! Right now!*), but over the next couple of years. This also suggests that the half-life of any given model is going to be pretty short as we keep trading up, the way we've been doing with cell phones for the past decade or more.

Wireless PDAs are going to flush a lot of other gizmos from our pockets, purses, attaché cases, and belts. Even if we can't cruise the Web the way we'd like, even if inputting messages is a mess, even if—period. And not a minute too soon, say I, as I go clanking down the airport concourse once again. **PC**

Product Graphics

Where is the new Package?
What Web Graphics?

Where are the Web Banners.

Where is the logo?

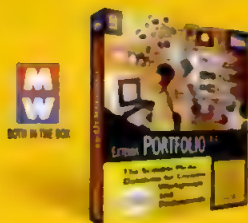
Can you find the Copy?

Presentation files?

Where are the Catalog files?



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My Perfect PC

For weeks, the editors and technical staff at *PC Magazine* heatedly discussed how to configure the Perfect PC. What you're reading in this issue is our collective best judgment. This year we've been more realistic; for instance, you won't find cost-is-no-object, \$3,000 home PCs. What you're reading on this

page, though, is how I'd spend *my* money. And my Perfect PC is more high-end than low-end. I want most of the expansion and upgrading done now, because I'm nervous that things can and do go wrong every time you open the case to upgrade. Write that on your hand before you go to the store or dial the phone. Also, do anything you can to minimize the use of interrupt requests (IRQs) and printer or serial ports; get USB, SCSI, IEEE 1394 (FireWire), or Ethernet devices.

CPU and memory. I'd go with a Pentium III/500 (or 450) and 128MB of RAM. Rule of thumb: Buy one or two notches down from the top (PIII is up to 550 now) to get the best bang for the buck. A top-of-the-line AMD K6 would be acceptable too.

Mass storage. 20GB is about right for the main drive. I'd get a DVD drive, because the technology is about to get useful: DVD software titles are starting to appear. CD-R is the best and cheapest archival backup medium, and CD-RW is great for shorter-term backup. I'd also get a 2GB Iomega Jaz drive for its huge capacity. This many devices calls for a mini-tower with four or five accessible bays.

Monitor and graphics. I want a 21-inch monitor. I'd buy 19 inches, because of the size and cost savings. I run at the little-known 1,152-by-864 resolution, sometimes at 1,600-by-1,200 when I need to see a lot of images on-screen. My eyes can't hack that on a 17-inch CRT. As for graphics chips, I'd put 16MB of RAM on whatever is hot at the moment: the nVidia RIVA TNT-2, Matrox G400, or possibly ATI Rage 128 Pro.

Input/output. Every PC comes with at least two USB ports, but having four is even nicer. I'd also go with a good SCSI adapter, not so much for the potential speed, but because you can hang six SCSI devices off the card using just one IRQ. I'd definitely get a PC Card slot. I also want an Ethernet card on-board, either for networking or for a cable modem; you might even consider a dual-Ethernet card. And I want a FireWire adapter for editing video from my DV camcorder.

Communications and networking. Ignore the 56-Kbps modem that's included and get a cable or DSL

modem. The speed is phenomenal. With cable, rent the modem now (\$10 a month) and buy one of the so-called DocSys-compliant modems once they come out. You can use these modems in any cable system in the country—but make sure yours has USB. You need Ethernet to connect your cable modem (USB cable modems are coming) or for networking. I like genuine Ethernet networking, either wired (from many makers) or wireless (from Aironet today, others including 3Com by year's end). Phone-line networking (HomePNA) has too many gotchas right now.

USB peripherals. When possible, stick with USB peripherals: printers, scanners, and digital cameras.

Details that make a difference. Home PC keyboards are better than business PC keyboards, because of the neat extra buttons: audio control, phone control, and one-touch Internet access. Some PCs have convenience outlets for monitor power, which are a blessing if your room is short on AC outlets. Get an uninterruptible power supply (\$100 to \$200) to save your data when the lights go out unexpectedly. Swap the cheap mouse included with your PC for a decent one, and get one of the grippy Kensington or 3M mouse pads. Or you can wait for the Microsoft IntelliSense mouse, due this fall; it doesn't need a pad.

Service and reliability. The quality of PCs is so high today that I'd be happy with any vendor that earns C's or above on our latest reader survey and average or above-average buy-again scores. (See "Desktops and Notebooks: Service and Reliability" in this issue.)

Price it out and you'll find that my perfect PC costs on the high side of \$2,000—twice what most users pay for personal PCs. I don't trust some money-saving claims: "You can easily add it later," "DVD video doesn't need a hardware decoder," and "HomePNA is a snap to install." To save a few bucks, ask around for refurb and factory outlet sales.

If you need a second PC for Web surfing, the drill is simple: Spend \$1,000 max, get an AMD K6-2 or Intel Celeron CPU, buy from a vendor with decent Service and Reliability Survey grades, and have the seller stick in a network card. **PC**



Rule of thumb: Buy one or two notches down from the top (Pentium III is up to 550 now) to get the best bang for the buck.

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SPECIAL ISSUE

The

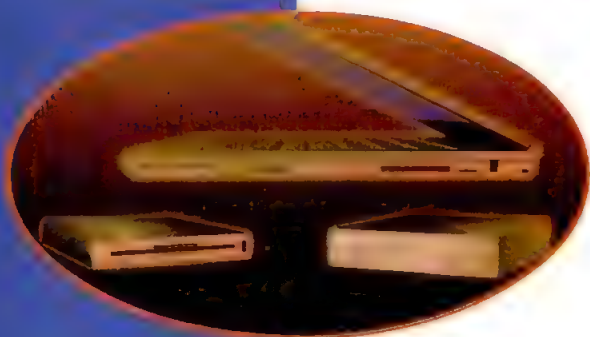
Perfect

PC
For You

*WE'VE EXAMINED THE NEW TECHNOLOGIES AND
THE TOP MANUFACTURERS TO HELP YOU MAKE
THE RIGHT CHOICES.*

IT'S ALL SUBJECTIVE. YOUR PERFECT PC MAY NOT BE MY PERFECT PC. Your perfect PC at work differs from your perfect PC at home. Uncle Ralph's perfect PC must cost no more than \$799; that's okay for your surf-the-Web-only second or third PC, but you want your main PC to be fast for at least three years. And you want to pick the perfect PC vendor—the one that provides the right mix of products, services, support, reliability, and stability for your needs. This issue helps you choose the PC that's right for *you*: the power user, mobile user, corporate user, home user, technical user, or corporate IS manager.

You'll find more this year on manufacturers and the buying process. Our profiles of the top vendors include information on their product lines, Web site experience, and service offerings. Finally, our exclusive Service and Reliability Survey expands this year to break out office and home PCs, and we continue to bring you survey scores for notebooks and printers. Our Support and Satisfaction Survey adds grades for Internet service providers and continues with office suites, operating systems, Web browsers, and e-mail.



ILLUSTRATIONS BY
VISUAL LOGIC



The Power User needs the most powerful desktop or portable PC available. If you are a Web developer, graphic arts professional, or savvy home user into digital imaging and video, this section is for you. In this section, you'll also see what the top PC makers offer in terms of service and support. *Page 102*

The Mobile User spends most of the time on the road, making sales calls, presentations, and the like, or shuttling a machine between work and home, squeezing in bouts of e-mail on the train. This section shows you the machines you need to stay connected, as well as how the top vendors compare. *Page 114*

The Corporate User needs a fairly utilitarian machine to handle the basics: word processing, e-mail, Web research. More important than the hardware are the manageability and serviceability issues that make life easier for the IT director. And we've polled the leading corporate PC makers to see what they offer. *Page 132*

The Home User may want a bare-bones machine simply for surfing the Internet, a loaded machine for arcade-quality gaming, or something in between. We tell you the particulars you should specify for each type of machine, as well as how well the name-brand players stack up in terms of warranty, support, and extras. *Page 146*

The Technical User is in the market for a heavy-duty workstation for CAD, 3-D modeling and animation, or video production. Look here for our hardware recommendations. *Page 168*

The Corporate IS Manager needs to specify not only the servers but the entire network infrastructure. This section shows you how to pull it all together. *Page 170*



Plus:

The Best and The Worst

Thousands of *PC Magazine* readers rate...

- **Desktop PCs** *page 183*
- **Notebooks** *page 183*
- **Printers** *page 209*
- **Software** *page 217*
- **Internet service providers** *page 229*

...for service, support, reliability, and overall user satisfaction.

THE Power USER

DEMANDING TASKS CALL FOR A ROBUST MACHINE. THIS DREAM PC IS THE BEST MONEY CAN BUY.

By Jamie M. Bsales and Cade Metz

WE START THESE DESCRIPTIONS OF THE Perfect PC with our recommendations for a dream machine. In all likelihood, 90 percent of users don't need a PC this powerful or well equipped, but looking at the top of the line first lets you see the range of options available as you put together your own system.

We refer to the 10 percent who do need this class of machine as *power users*. They are Web developers, image editors, and desktop publishers, as well as corporate professionals or home-business users who need a powerful machine for running the show. Note that some users, such as 3-D developers, engineers, and audiovisual professionals, will need an even more powerful workstation, which we address in the section "The Technical Pro."

The Hardware

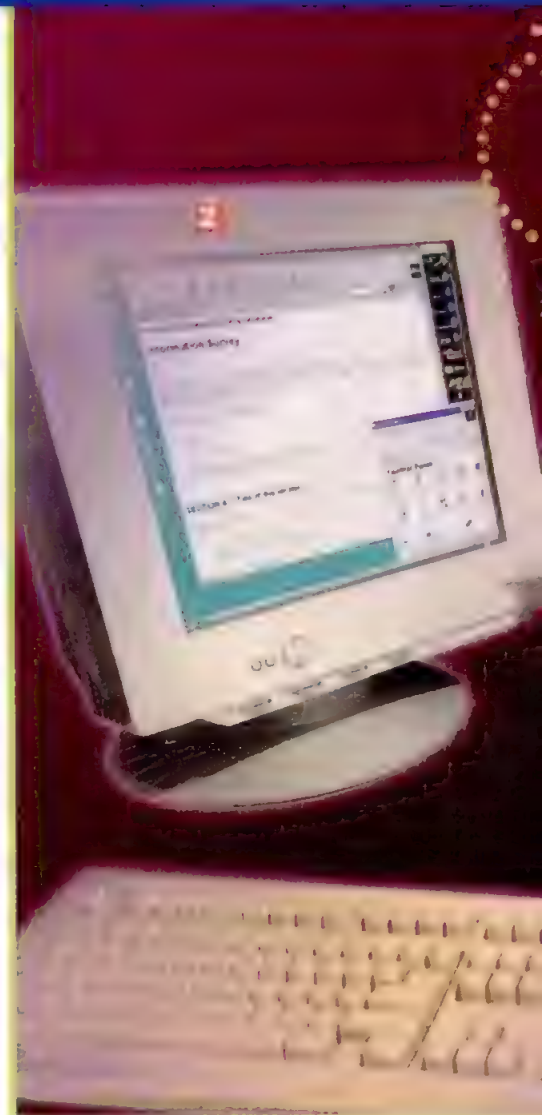
To build the most powerful machine, you need the most powerful desktop processor. Right now, that means the Intel Pentium III/550 chip set. AMD is positioning the forthcoming AMD-K7 as a viable alternative to the Pentium III, but it was not available for performance testing in time for this story. We will test it and report our findings as soon as it is ready and incorporated into systems.

Like the MMX instructions built into the Pentium II, a special instruction set—Streaming SIMD Extensions (or SSE)—was added to the Pentium III to boost performance for certain types of applications. Some of the more advanced Web plug-ins (Macromedia Flash, MetaStream, and Shockwave, to name a few) are optimized for SSE. Right now, these technologies are used by a handful of sites (for interactive 3-D graphics at sharperimage.com, for

example), and such sites should become more prevalent as the Pentium III becomes the dominant installed platform.

As for everyday apps, a typical Pentium III/550 configuration performs about 20 percent faster than a Pentium II/450, our recommended power-user configuration last year in this feature. We also recommend 128MB of RAM, especially if Microsoft Windows NT is your OS of choice. Also note that, in the publishing and imaging fields especially, Macintosh is the dominant platform, so a machine like the Apple Power Macintosh G3 may be your best choice.

You'll want to marry the CPU to the most powerful graphics subsystem available. Graphics chip makers continue to leapfrog one another when it comes to 3-D performance, and the leader keeps changing, depending on which one has the latest rev of silicon on the street. From what we've seen in our labs, the current speed demons are cards based on the ATI Rage 128, Matrox G400, or nVidia RIVA TNT2, and the soon-to-be-released 3Dfx Voodoo3 should also



You Are...

- a Web or multimedia developer working in an office environment.
- a graphics arts professional involved with desktop publishing or image editing.
- a corporate executive who needs a powerful machine for creating presentations, reports, and complex spreadsheets.
- a technically savvy home user into digital photography, digital video, or Web authoring.



You Need...

- Pentium III/500 processor
 - 128MB RAM
 - 20GB to 25GB Ultra DMA/66 or Ultra SCSI-2 hard disk
 - 2-D/3-D graphics accelerator (ATI Rage 128, Matrox G400, or nVidia RIVA TNT-2 chip set recommended), 32MB video RAM **1**
 - 19-inch monitor (0.28-mm mask pitch maximum; 1,280-by-1,024 resolution at 85-Hz refresh minimum) or 18-inch LCD (1,280-by-1,024 resolution at 80-Hz refresh minimum) **2**
 - cable or DSL modem (56.6K V.90 modem in areas where high-speed service is unavailable) **3**
 - DVD-RAM drive, or a 6X DVD-ROM drive plus a CD-RW drive **4**
 - hardware DVD decoder (optional) **5**
 - 3-D sound card **6**
 - three-piece surround-sound speaker set **7**
 - Microsoft Windows NT 4.0 (office); Windows 98 (home)
 - also: easy-access chassis and components, three-year warranty (including free telephone support), plus Web-based order tracking and technical support
- \$2,500**

fall in this upper echelon. Specifying any of these chips now gives you obsolescence insurance for the coming year.

Whatever the chip set, we recommend that you specify 32MB of video RAM and an AGP 4X configuration. You'll need at least 32MB of RAM to run your 3-D games at 1,280-by-1,024 resolution in true-color mode (16 million colors), with triple buffering, a 24-bit Z-buffer, and room for textures stored locally in the frame buffer. AGP 4X offers better peak throughput than AGP 2X. Also, future graphics accelerators will have larger on-board capabilities (up to 128MB) as well as dedicated geometry processing, which means the AGP pipe will need to carry much more data than AGP 2X can support.

At this processor level, a dedicated hardware DVD decoder is optional. We found that a Pentium III/550 working in concert with the motion compensation that the latest graphics chips provide delivers a smooth video stream without overtaxing the CPU. But if you plan on

running DVD-based video while other applications are active, adding a dedicated hardware decoder (about \$100) is a good idea.

And as long as you have the best video, you'll want a big-screen monitor to see it all. Our perfect PC has a 19-inch monitor (capable of 1,280-by-1,024 resolution), which lets you view much larger areas of the images or spreadsheets you're working on. It also gives you the screen real estate to have multiple applications open and accessible at once, so you can keep an eye on your e-mail in-box as you surf the Internet. Be sure to specify a short-depth CRT: A regular 19-inch CRT will be about 20 inches deep, while a short-depth occupies the same footprint (front to back) as a 17-inch model. Some users—especially image editors and desktop publishers—will want to trade up to a 21-inch monitor (\$1,200).

An aperture-grille tube is generally preferred by graphics-intensive users, as colors tend to be more saturated than what you get from a traditional shadow-mask CRT. A moni-



DESKTOP REPLACEMENT: You Need...

- Mobile Pentium II/400 processor
 - 4MB 2-D/3-D graphics
 - 14- or 15-inch TFT display **1**
 - 128MB RAM
 - Internal 56.6K V.90 modem
 - 14GB hard disk
 - 4X DVD-ROM drive **2**
 - swappable high-capacity floppy disk drive **3**
 - Type III PC Card slot **4**
 - also: USB ports, extra lithium ion battery, docking station
- 8 to 9 pounds, \$3,500

tor built around an aperture-grille tube (either a Sony Trinitron or Mitsubishi Diamondtron) will command a \$50 premium over a shadow-mask CRT. Be warned that the two hair-thin horizontal wires that hold the mask in place are visible, and distracting to some users. Which-ever you choose, look for a mask pitch of 0.27mm or less, along with a full range of image controls, to help ensure a sharp picture.

As hard disk prices continue to plummet, you won't break the bank with a 20GB or even a 25GB unit. Although this might seem like overkill, remember that the digital images from a camera, a scanner, a video camera, or the Web consume disk space voraciously. We recommend a 7,200-rpm unit and either Ultra DMA/66 or Ultra SCSI-2 for the interface. On our tests, we found only a minimal performance advantage (about 2 percent) with SCSI versus EIDE for mainstream business applications. A SCSI dish subsystem can boost performance, however, by unburdening the CPU. This is evident when an application requires parallel operations involving both hard disk and CPU (applying an Adobe Photoshop filter to an image, for

example). So if your work involves large, computationally demanding files, go for SCSI.

You'll also want a removable-storage drive for backing up important files and archiving others so your primary disk isn't a dumping ground. One to consider is DVD-RAM, which offers 5.2GB of capacity (2.6GB per side) per \$30 cartridge and which also reads standard CD and DVD disks. If you are a graphics professional who needs to share image files with a service bureau, then the Iomega Jaz format (available in 1GB and 2GB iterations) might be a better choice (see the table "Removable Storage Options" for other players).

Special Considerations

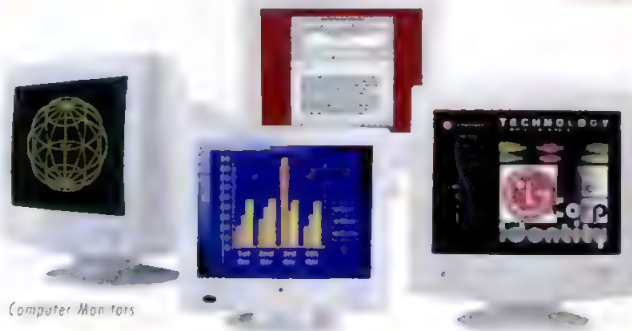
As the saying goes, a chain is only as strong as its weakest link. In the machine we just built, the weak link would be a 56.6K modem. But there are alternatives. We urge any users who have cable-modem or DSL service in their areas (your cable provider or local phone company can provide this information) to invest in one of these high-speed connections (\$150 to \$350 for the



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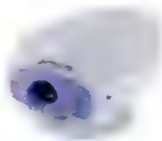


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Optical Disc Storage

Comparing System Performance

Here are the average scores for typical configurations aimed at power users, past and present.

ZD BUSINESS WINSTONE 99 (128MB RAM)



modem, as low as \$40 a month for the service). In addition to the raw speed—with either alternative, tens to hundreds of times as fast as 56.6K—these are constant connections, so there is no waiting to dial in or finding yourself out of luck during peak times. If neither service is available, consider a satellite system such as the Hughes DirecDuo (\$550 for the hardware, \$30 to \$50 a month for the service). This 18-inch dish delivers satellite TV services as well as a fast one-way link to the Web (you'll need a traditional modem connection for outgoing commands and e-mail).

Users who work with digital video should consider an IEEE 1394 (FireWire) add-in card for fast transfers, and all power users will want a 3-D-capable sound card with a good three-piece speaker system. And if money is no object, consider an 18-inch flat-panel LCD monitor (about \$3,000).

Mobile Power User

If you travel or need to bring a laptop to and from work on occasion, you can put together a portable system that delivers nearly the power of a desktop machine but much more flexibility. Granted, at 8 to 9 pounds our desktop-replacement portable isn't for weight-conscious road warriors (see the following section, "The Mobile User," for machines better suited to those who travel frequently). But you can get a Mobile Pentium II/400 processor, 128MB of RAM, a 4MB to 8MB 2-D/3-D graphics subsystem, a 14GB hard disk, and even a 15-inch display.

In addition to the hard disk, the machine will have bays for a DVD-ROM drive plus a high-

capacity floppy-disk drive alternative (such as the Iomega Zip Drive or Imation SuperDisk). You can replace those removable drives with a host of options, from a second hard disk to an extra battery. You'll also want to buy the port replicator or docking station offered by the manufacturer. This lets you have a full-size keyboard, a monitor, and other peripherals permanently attached at your primary work area while you simply pop the portable out of the cradle and go. This lets you have a single machine with the convenient features of a desktop and the flexibility of a portable.

Software

Beyond the basics of the operating system (Windows NT in a corporate setting, Windows 98 for a home or small office) and productivity applications (one of the office suites, such as Microsoft Office 2000), the power user will want to augment the software arsenal with extras. Invest in a good antivirus package (our favorite is Norton AntiVirus), a file compression program (WinZip or ZipIT), and a PIM that can synchronize with a palmtop or Windows CE hand-held device (see our latest Utility Guide, *PC Magazine*, May 4, 1999). A financial management package such as Intuit's Quicken is in order, as is a Web authoring tool (we like Macromedia's Dreamweaver). To get the most from the Web, download RealAudio and RealJukebox for playing music files and Macromedia's Flash and Shockwave for more advanced multimedia files.

The New Generation of Graphics Chips

✓ Yes ✗ No	ATI Rage 128	Matrox G400	nVidia RIVA TNT2	Permedia 3	S3 Savage	3Dfx Voodoo 3
2-D performance	Excellent	Excellent	Excellent	Excellent	Good	Excellent
3-D performance	Good	Excellent	Excellent	Good	Good	Good
KEY HARDWARE FEATURES						
AGP 4X support	✓	✓	✓	✗	✓	✗
Texture color depth	32-bit	32-bit	32-bit	32-bit	32-bit	16-bit
Stencil buffering	✓	✓	✓	✓	✓	✗
Bump mapping	✓	✓	✓	✓	✓	✓
Single-cycle trilinear multitexturing	✗	✓	✓	✓	✓	✗
Texture compression	✓	✗	✓	✗	✓	✓
DVD motion compensation	✓	✗	✗	✓	✓	✗
DISPLAY SUPPORT						
Dual monitors	✗	✓	✗	✗	✗	✓
Digital flat panels	✓	✓	✓	✓	✓	✓

Beyond the Box

The right hardware and software are only two-thirds of the equation. You'll also want a machine that boasts a well-designed chassis so you can add memory, upgrade components, or replace drives easily. Better designs let you access the PC's innards without tools, and they include drives that slide out easily. Also check to see that there is room to upgrade. We recommend at least two available PCI slots and three drive bays free.

At this price level, you want to make sure a vendor's support offerings are top-tier. Insist on at least a three-year warranty, with technical support included for the warranty period. Web-based ordering and order tracking are a plus. Be sure there is a place to post your questions and to check for driver updates based on your particular model.

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Removable Storage Options

	Media capacity	Approximate drive cost	Media cost per megabyte	Interfaces available	Comments
FLOPPY DISK ALTERNATIVES					
Iomega Zip Drive 100	100MB	\$100	\$1.00	Parallel, IDE, SCSI, USB	The most popular removable storage drive, and the best choice for exchanging data with others.
Iomega Zip Drive 250	250MB	\$200	\$1.25	Parallel, SCSI	A new, higher-end version of the 100MB Zip. The drive can read 100MB cartridges.
Imation SuperDisk	120MB	\$150-\$250	\$1.25-\$2.00	Parallel, IDE, SCSI, USB, PC Card	Popular in notebooks; the drive can read and write to standard floppy disks in addition to 120MB SuperDisk cartridges.
Sony HiFD	200MB	\$200	7.5 cents	Parallel	A new competitor to SuperDisk and Zip drives; HiFD can read and write to standard floppy disks.
CD-R	650MB	\$200-\$400	Less than 1 cent	Parallel, IDE, SCSI, USB, PC Card	The best deal on the market for write-once data distribution; large media; any CD-ROM drive can read the disks.
CD-RW	650MB	\$300-\$500	Less than 1 cent	Parallel, IDE, SCSI, USB, PC Card	Increasingly appealing as removable storage, but the drives are still expensive; can use CD-R or CD-RW media.
HARD DISK COMPLEMENTS					
Castlewood ORB	2.2GB	\$200	9 cents	Parallel, SCSI, USB, FireWire	Based on magnetoresistive Winchester hard disk technology. The spiritual successor to SyQuest.
Iomega Jaz Drive 1GB	1GB	\$275-\$300	25 cents	SCSI	Popular with image editors and service bureaus.
Iomega Jaz Drive 2GB	2GB	\$350-\$400	15-20 cents	SCSI	A fast choice for backing up large portions of your hard disk.
DVD-RAM	5.2GB	\$600-\$800	8 cents	SCSI	Promising as a desktop solution; the drives can also read (but not write) CDs and DVDs.
DVD+RW (future)	5.6GB	\$600-\$800	7 cents	EIDE, SCSI	The drives can read (but not write) CDs and DVDs; DVD-RAM has a head start.
CONSUMER TAPE DRIVES					
Travan	8GB-20GB	\$400-\$650	3-5 cents	Parallel, IDE, SCSI, USB	Though slower than many other types of removable storage, tape remains the cheapest backup medium for the consumer desktop.



► PC Magazine Online

www.pcmag.com

For up-to-date reviews of the latest hardware and software products, plus industry news and opinions, visit our Web site. Find reviews by product name or topic, or search our back issues.

► techguide.com

www.techguide.com

This site is a treasure trove of information for technology professionals and enthusiasts alike. The editors distill complex (and often biased) information from vendor-generated white papers to create understandable technology guides on a range of topics, from communications and Internet technology to data warehousing.

What You Get from the Top Companies

Apple Computer Inc. Apple kept the end user in mind when designing its latest desktop, the Power Macintosh G3. Encased in a colorful, translucent bezel, this majestic system is not only aesthetically pleasing but also remarkably easy to set up, operate, and maintain. You'll need only 3 minutes to get the G3 up and running and just a gentle tug on a side door to gain access to its interior. Much to the delight of fervent Apple fans everywhere, the G3's performance is on a par with many leading Pentium-based machines, offering end users a welcome hybrid of friendly, consumer desktop and vigorous, power-user system.

Predictably, Apple's Web site—where you can order machines configured to your liking, locate an Apple reseller in your area, or obtain technical support—is as attractive and user-friendly as the G3 chassis. It's also well organized, supplying pull-down menus where they are needed and graphics where graphics are needed. One thing you won't find on the Apple site is information on the company

warranty, which covers parts and labor for only a year, though that includes on-site service. (Cupertino, CA; 800-795-1000; www.apple.com.)

Compaq Computer Corp. Since last fall's introduction of the Compaq Prosignia line—a series of desktops, notebooks, servers, and services meant for small and growing businesses—Compaq has operated as both a direct and an indirect vendor. Offering the latest in mainstream processors, hard disks, and graphics engines, Prosignia desktops can be purchased—configured to your specifications—over the phone, via the Web, or from a Compaq reseller. These systems are brilliantly designed, offering uniquely tractable chassis, extensive setup tools and software, easy access to the Web, and generous support policies. Each also gives you entry to Compaq's new Online Services, which let you back up files securely online, create Internet sites for selling products, remotely access your machines, and much more.

Though businesses give Compaq an unexpected C on our latest Service and Reliability Survey, the company's three-year warranty (with one year of on-site labor) is in line with the rest of the industry, and greater coverage can be purchased through the Compaq CarePak services program. Furthermore, Compaq's Web page is—like the Apple and Dell sites—attractively designed, easy to use, helpful, and quite informative. You can easily purchase Prosignia desktops from the Web site and later service those systems via the site as well, readily accessing various help manuals, known bug fixes, and software updates specific to your Prosignia models. (Houston; 800-345-1518; www.compaq.com.)

Dell Computer Corp. Though the Dell Dimension is certainly a proficient and reliable power-user desktop, its leading attributes derive not from its individual hardware components but from Dell's highly successful direct business model. Dell typically tags its systems with low prices and provides—according to our readers—some of the best technical support on the market. The leading Dimension is always fast and relatively easy to use. It isn't conceptually unique, but capacious hard disks and Zip Drives are common.

The recipient of an A grade on our Service and Reliability Survey, Dell matches the warranties of Gateway and NEC, offering three years on parts, three years of labor, and a year of on-site service via BancTech Service Corp. Remarkably, the company typically provides this on-site service within 24 hours of diagnosing a problem with your system. In case you wish to handle minor problems on your own, the Dell Web site is equipped with perhaps the market's leading Internet-based support engine. When you supply your system's unique Express Service Code, the site serves up driver updates, BIOS updates, and other fixes specific to the machine's hardware and software. Dell is famous for selling all of its systems directly, over either the phone or the Web. (Round Rock, TX; 800-388-8542; www.dell.com.)

Gateway. Whereas Dell's business leans towards the classic corporate customer, Gateway—Dell's direct-market competitor—is generally more concerned with individual and small-business users. Available online, over the phone, or from one of Gateway's 155 country stores nationwide, the company's aptly named line of Performance computers is hardly unusu-

al in look or concept, but the machines are well supported by help documentation and are typically very fast. One of the first major vendors to adopt UltraATA-66 hard disk controllers, Gateway even equips many of its Performance models with the workstation-class Intel Pentium III Xeon chip.

Though just weeks ago we were bemoaning Gateway's Web site, unhappy with its dated sales tools and unappealing look, the company recently revamped the site to great effect, providing a much friendlier, more effective buying process. This site has always been a great resource for support tools, serving up an eclectic range of downloadable software updates and an interactive wizard for troubleshooting common system problems. Gateway's three-year parts-and-labor warranty—which includes a year of on-site service—is also better than average, but the Performance line's unique advantage over competitors lies with SpotHelp, a software-based support engine loaded with electronic documentation and video tutorials. (North Sioux City, SD; 800-315-2536; www.gateway.com.)

IBM Corp. Everything about the IBM Aptiva S Series says art. Its modern design is aesthetically appealing and is priced accordingly. In fact, the high-end S Series 651 is an exclusive, available only from the American Express catalog. For everyone else, the S Series 631 can be found through retail stores as well as on the IBM Web page. Component upgrades can drive the 631 from its \$2,000 street price up past \$3,200, if you opt for the flat-panel screen (\$1,100 street) and the radial arm (\$149 direct). Configured with built-in sound and DVD with software decoding, the S Series would be appropriate for a home office or a user looking for a safe upgrading base.

IBM's A on our Service and Reliability Survey reflects the company's excellent support offerings. The Owner Privileges program, available at no charge the first year and for \$19.95 each year thereafter, supplies a toll-free technical-support number and other convenient services. EasyChoice, a partnership with Chumbo (<http://ibm.chumbo.com>), gives owners a hefty

According to our readers, **Dell** delivers some of the **BEST** technical support on the market.

The Apple Macintosh G3 might be the right choice for the publishing power user.



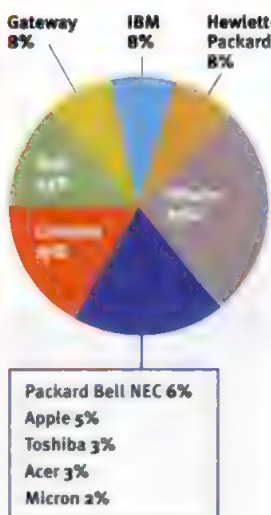
Power User Service and Support Policies

✓ Yes ✗ No	Vendor grade*	Money-back guarantee	Technical support hours (eastern time)	Free telephone support	Technical support Web site	Standard warranty on parts/labor	On-site service handled by	On-site service for first year	Contract for on-site service within 4 hours	Average turnaround time for PC repair	Shipping paid	Orders accepted via the Web	Order tracking via the Web	Custom Web pages for volume customers	Web support according to model	E-mail notification of driver updates
Apple	B	Varies with dealer	9:00–9:00, 7 days	90 days	www.apple.com/support	1 year/1 year	Authorized service provider	Included	N/A	2–3 days	Carry-in service only	✓	✓	✓	✓	✓
Compaq	D	30 days	24 hours, 7 days	Lifetime	www.compaq.com/support	3 years/1 year	Decision One/Compaq Services	Included	N/A	2 days	Return only	✓	✓	✓	✓	✓
Dell	A	30 days	24 hours, 7 days	Lifetime	www.dell.com	3 years/3 years	BancTech Service Corp.	Included	N/A	1 day	Both ways	✓	✓	✓	✓	✓
Gateway	C	30 days	24 hours, 7 days	Lifetime	www.gateway.com/support	3 years/3 years	TSS	Included	N/A	3–5 days	Both ways	✓	✓	✗	✓	✗
IBM	A	Varies with dealer	24 hours, 7 days	1 year	www.pc.ibm.com/support	1 year/1 year	N/A	N/A	N/A	N/A	N/A	✓	✗	✓	✓	✓
Micron	B	30 days	24 hours, 7 days	Lifetime	support.micronpc.com	3 years/3 years	Unisys	Included	N/A	1–2 days	Return only	✓	✓	✓	✗	✗
MidWest Micro	D	30 days	24 hours, 7 days	Lifetime	www.mwmicro.com/support	3 years/3 years	Decision One	Included	N/A	2 days	Return only	✓	✓	✗	✗	✗
Quantex	A	30 days	24 hours, 7 days	Lifetime	www.quantex.com	3 years/1 year	Philips Mag-navox	Included	N/A	1–2 days	Both ways	✓	✓	✓	✓	✗
Sony	B	Varies with dealer	24 hours, 7 days	1 year	www.itsa.sony.com/support/pc	1 year/1 year	Multiple vendors	Included	N/A	7–10 days	Both ways	✓	✗	✗	✓	✗

* Based on PC Magazine's 1999 Service and Reliability Survey. N/A—Not applicable: The vendor does not offer this service.

Top 10 PC Vendors

Here are the market-leading PC makers, taking into account all categories. Dell's is the number to watch in 1999.



Figures are 1998 U.S. unit shipments.

Source: International Data Corp., May 1999 (www.idc.com).

discount on slightly dated software. Update Connector e-mails users to notify them of driver updates and, with or without an ISP, can connect to the Internet and download the appropriate files.

Returning in this latest high-end Aptiva line are the ScrollPoint wheel mouse and the Rapid-Access keyboard, which offers enhanced interaction in the form of volume controls and configurable Web hotkeys. Two free PCI slots, two USB ports, and five free IRQs make this system very upgradable. (Armonk, NY; 800-426-7255; www.ibm.com.)

Micron Electronics. Often thought of as the market's third major direct vendor—behind Dell and Gateway—Micron has recently enlivened its Millennium Max line of Pentium III PCs with a new bezel and several complimentary Internet-based services, placing these power-user machines among the market leaders. Available over the phone, via the Web, or from the lone Micron retail store in Idaho, the Millennium Max line is now—thanks to Micron's revamped bezel—readily upgraded and repaired, something that could rarely be said of past Micron

models. Though you'll need a screwdriver to remove the system's drives, all internal hardware is neatly arranged and properly cooled. The Millennium Max line is also available in desktop and full-tower cases.

With each Millennium, Micron includes a convenient Internet wizard (plus 30 days of free access) and a year's subscription to Micron University (providing computer-related classes via the Web). Through a partnership with Unisys, Micron's new MServices warranty program covers the Millennium's CPU and memory for five years and all its other parts for three years, while affording a year of on-site service. You can, however, purchase an additional two years of on-site service for only \$99 and gain a year of free Internet access in the process. In case you need to service a system on your own, the company posts a fair amount of support tools on its public Web site and builds custom sales and support sites for very large customers. (Nampa, ID; 888-634-8799; www.micronpc.com.)

MidWest Micro. Best known for its mail-order catalog—with a circulation now well over a million—MidWest Micro has been selling PCs over

LOOK AGAIN.



If you haven't looked at us lately, now's the time. We've created a dynamic array of state-of-the-art monitors with built-in features the others don't offer. And our technical support is unmatched. There's never been a better time to take a good hard look at MAG InnoVision monitors.

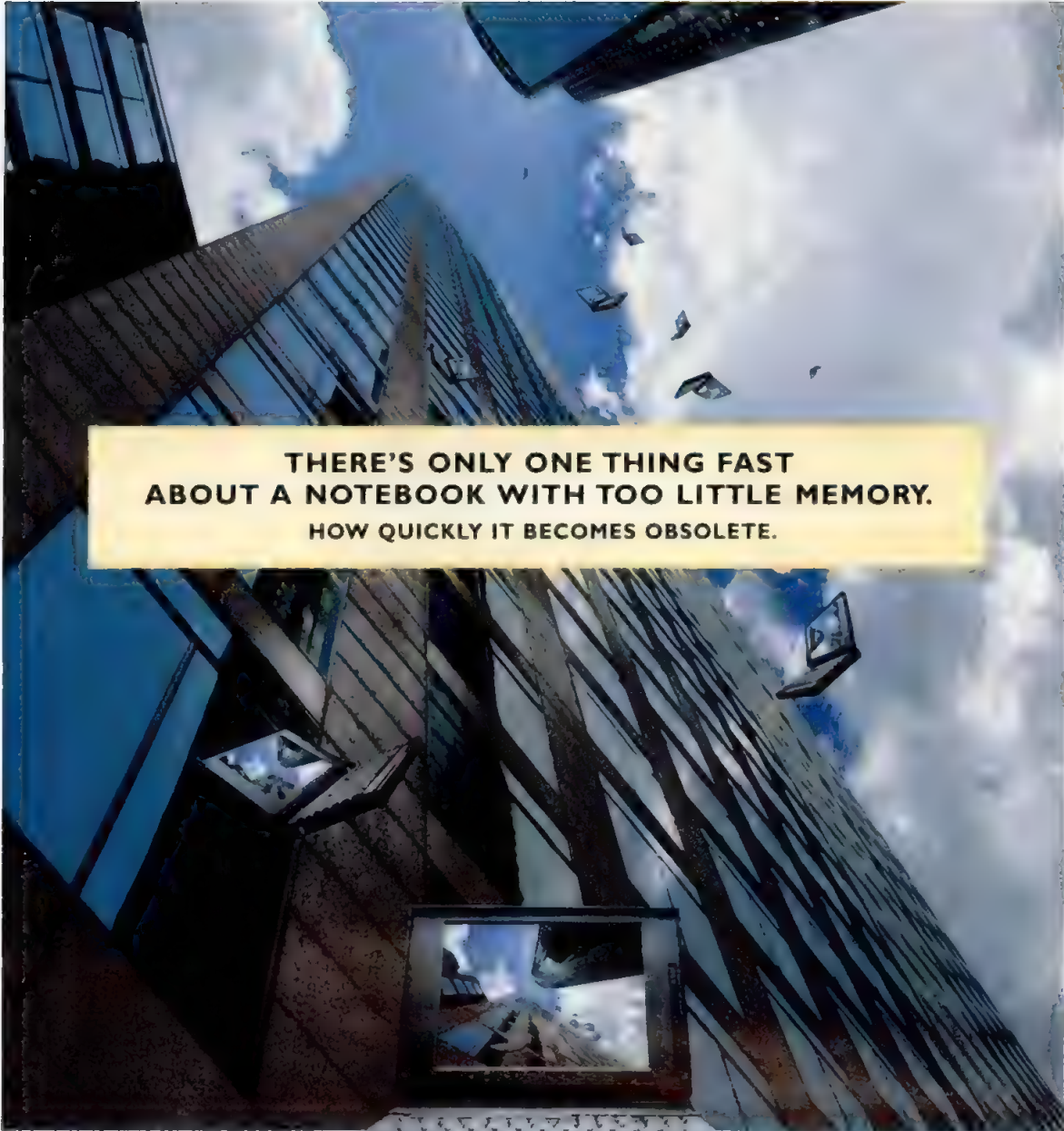
STILL THE INNOVATOR.

We give you exclusive features like our user-friendly, multi-feature JAG® control. For superb image quality, our Trinitron®-based monitors use the most advanced aperture grille technology available, so they're brighter and deliver higher contrast than CRTs using a shadow mask.

THE TECHNICAL SUPPORT YOU EXPECT.

Every MAG monitor comes with support that's second to none. Including our MAGIC Advance Replacement Program, which provides you with a replacement monitor within 48 hours in the event of a malfunction. You also get interactive technical support on our web site, and a standard three-year limited warranty on parts, CRT and labor. To learn more about MAG products or visit our web site at www.maginnovision.com. Chances are, you'll see just what you've been looking for.





**THERE'S ONLY ONE THING FAST
ABOUT A NOTEBOOK WITH TOO LITTLE MEMORY.
HOW QUICKLY IT BECOMES OBSOLETE.**



IT'S EASY TO SPOT A NOTEBOOK PC WITH INSUFFICIENT MEMORY. You spend too much time staring at the hourglass and too little time getting things done. That's because insufficient memory forces your notebook to create a "virtual" memory file on your hard drive that slows performance to a crawl. Fortunately, there's a simple cure: more Kingston® memory. Adding memory can double the life of your notebook for a fraction of the cost of buying a new one. Why Kingston? Because Kingston tests every cell on every chip on every module—on a 128MB module that's over a billion cells. And each module is backed by a lifetime warranty. How's that for a safety net? To find out how much Kingston notebook memory can save you, just call (800) 337-8420. Or visit our Web site at www.kingston.com.

Kingston
TECHNOLOGY
COMPUTING WITHOUT LIMITS®



the phone since 1992 and now offers its machines via a Web-based catalog as well. Having begun as a peripherals vendor, the company also sells an imposing variety of other PC-related items, including books and office equipment as well as scanners, monitors, drives, and modems. The company's flagship power-user system is the Multimedia Pro, a 3-foot-high tower, typically equipped with the finest in sound cards and a surprisingly effective set of flat-panel speakers from Monsoon. This system isn't for small spaces and is somewhat difficult to service by hand, but it's sturdy and relatively inexpensive.

Like that of Micron Electronics, Midwest's standard warranty provides more coverage for CPUs and memory (five years) than for the rest of a system's hardware (three years). It also includes a year of on-site service via Decision One and two additional years of off-site labor. An upgrade to a full three years of on-site support is but \$99. The company offers minimal support on its Web sites—a library of downloadable file updates and a technicians' manual—but assigns dedicated sales and support teams to large customers. (Fletcher, OH; 800-626-0544; www.mwmicro.com.)

Quantex Microsystems. Having adopted the direct-sales model in 1991, Quantex sells machines over the phone and via the Web, including three distinct models designed for the power user. Its primary power-user line is the SM series, which consists of high-end multimedia systems appropriate for the PC enthusiast as well as the small business. The model we recently examined at PC Magazine Labs included a leading 3-D card and a DVD drive as well as the much-anticipated Castlewood ORB drive, which provides over 2GB of storage on a removable hard disk cartridge. Alternatively, power users may decide to choose the company's GX Series PC (subtitled "the ultimate gaming machine") or a VX Series slimline PC, whose bezel measures only 3.3 by 12.9 by 14.2 inches (HWD).

In the past, Quantex has lagged behind many large vendors in the areas of ease of use, service, and support. This year, however,

Quantex achieved an impressive overall grade of A on our reader Service and Reliability Survey. The company backs each system with a three-year warranty on parts that also provides a year of on-site service through Philips Magnavox. Unusually, the company also lets you purchase an additional three years of on-site service. Online, Quantex's support offerings are adequate but scant compared with a Web site from Compaq or Dell; customized, private sites for large customers won't arrive until the fall, according to the company. (Somerset, NJ; 800-346-6572; www.quantex.com.)

Sony Electronics. Though the Sony line of VAIO desktops—meant for *Video and Audio Integrated Operation*—are officially consumer systems, they're often appropriate for power users and, in the case of the Slimtop LCD, small businesses. Ideal for cramped spaces, the Slimtop is a unobtrusive system—measuring 3.5 by 11 by 13.2 inches (HWD)—that connects to an equally unobtrusive flat-panel LCD. This attractively colored machine provides keyboard-mounted hotkeys for launching often-used programs and a Sony Memory Stick slot, which accepts the 4MB or 8MB Memory Sticks, which are no larger than

pieces of gum. These slots will soon be available with video cameras and digital cameras, letting you easily relay newly taken pictures to your PC or Sony photo printer. Sony also sells a VAIO Digital Studio machine, typically a micro-tower equipped with a Pentium III processor, a DVD or CD-RW drive, and i.Link, Sony's FireWire connector.

Though you can't custom-configure these systems before purchasing—at least, not in the way you can custom configure a Compaq or Dell—you can make your purchase

directly from Sony as well as from resellers and, notably, popular retailers. Ostensibly consumer systems, VAIO desktops ship with only a one-year warranty, but that year does include on-site service. On its Web site, Sony also provides SOS, a means of conversing live with a support technician, as well as online documentation, fixes for common problems, and minor software updates. (San Jose, CA; 888-476-6972; www.sony.com/pc.) 

IDEAL for
cramped spaces, the
Sony Slimtop is an
unobtrusive system.



User Tips

- ✓ **Never enough.** Hard disk storage is so affordable that you don't have to worry about overbuying. You'll appreciate not having to transfer files to removable media so often.
- ✓ **Hot interface.** Consider a machine that has an IEEE 1394 (FireWire) interface built in. It's the best way to get digital video into your machine, and other 1394 devices will certainly appear during your PC's lifetime.
- ✓ **Back it up.** Be sure to put together a system that has some kind of back up device (DVD-RAM or tape drive or Iomega Jaz drive)—and use it. You don't want to risk losing the image, video, or DTP files you've spent hours perfecting.
- ✓ **Not just for servers anymore.** Think about adding a personal UPS (uninterruptible power supply). It will give you a few minutes to save open files in the event of a power outage.

THE Mobile USER

IF IT SEEMS YOU ARE AWAY MORE THAN YOU'RE HOME, OR YOU CARRY A LAPTOP RELIGIOUSLY, THESE PCs ARE FOR YOU.

By Cade Metz

THE PORTABLE MARKET ISN'T AS SIMPLE AS IT once was. The rise of mini-notebooks, ultraportables, Windows CE machines, and Palm devices over the past year and a half has left many users confused by mere portable nomenclature, not to mention the process of actually buying a machine. In the accompanying sections on power, corporate, and home users, we describe the portable PCs best geared for their respective needs.

In this section we focus on mobile professionals—those who make frequent business trips or who shuttle a portable between the office and home—and the two types of machines they are most apt to specify: the presentation portable and the road-warrior notebook. Equipped with full-size keyboards, large displays, and all the standard I/O options, these are true mobile PCs—not pseudo-PCs in very small packages. We also describe the ideal complement to a desktop or portable PC: the new class of palmtops (such as 3Com/PalmPilot) and Windows CE devices.

The Mobile Presenter

Our perfect presentation portable weighs but 6 pounds and offers a single multipurpose drive bay rather than integrated I/O drives to keep the weight low. This bay can be used with a 4X DVD drive, a 24X CD-ROM drive, a high-capacity floppy disk drive (such as an Iomega Zip Drive or an Imation SuperDisk), a second hard disk, an extra battery, or—for all you



throw-backs—a standard floppy disk drive. This way, you

carry only what you need.

At the heart of this Windows 98 machine is a 400-MHz Mobile Pentium II processor, 64MB to 128MB of memory, a 2-D/3-D graphics engine with 4MB of its own memory, and a 10GB to 14GB hard disk to store rather hefty PowerPoint presentation files. Its active-matrix display measures at least 14 inches across the diagonal—though you may prefer a 15-inch model, now the largest available—so an audience gathered around a conference table can see your presentation clearly.

For communications, this system includes an integrated 56.6-Kbps V.90 modem. You *will* use a modem, so why bother with the hassles of a PC Card? You'll still need a Type III PC Card slot, however, should you have to add other peripherals (most notably a standard or wireless Ethernet adapter) in the future. We also recommend built-in stereo speakers (useful when presenting around a conference table), at least one USB port, and a removable lithium ion bat-

You Are...

- a businessperson who travels monthly and needs to carry a full-featured notebook that is also fairly light.
- shuttling a laptop between home and office almost daily.
- a sales professional, spending the majority of your time on the road.
- seeking a pocket-size device that can keep track of contacts and appointments, receive e-mail and specific Web content (like stock quotes), and sync with your PC.



You Need...

- Mobile Pentium II/400 processor
- 4MB 2-D/3-D graphics subsystem
- 14- or 15-inch TFT display **1**
- 64MB to 128MB RAM
- Internal 56.8K V.90 modem
- 10GB to 14GB hard disk
- multipurpose drive bay for a 4X DVD drive, 24X CD-ROM drive, second hard disk, or floppy disk drive **2**
- built-in stereo speakers **3**
- Type III PC Card slot **4**
- also: USB port, extra lithium ion battery, port replicator or docking station, Microsoft Windows 98, three-year warranty (including a 48-hour repair program and next-day on-site repair), one-year telephone support, lifetime Web support

5 to 8 pounds, \$2,700

FOR ROAD WARRIORS: ultra-thin (1-inch-thick), ultra-light (3- to 4-pound) model; 12- or 13-inch TFT display, Type III PC Card slot, external CD-ROM drive, external floppy disk drive **5**

\$2,500

tery (and a backup battery), plus an NTSC port so you can display the screen image on a TV when a PC monitor isn't available. If you plan on frequently using your notebook in the office or at home, you'll need a port replicator or docking station, so you can have a full-size keyboard, a full-size monitor, a mouse, and even a network connection by just sliding the PC into the cradle.

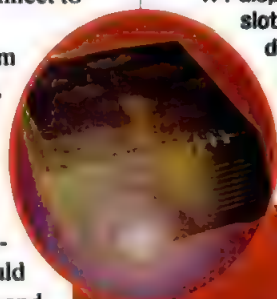
The Road Warrior

The "road warrior" is a frequent traveler for whom weight is the primary consideration. Since every ounce counts when you slog through airports every other week, our perfect road-warrior system is closer to 3 or 4 pounds and is roughly an inch thick. It has only a hard disk built in (the DVD, CD-ROM, and floppy disk drives are external add-ons), but it still includes a relatively large display (13 inches), a full-size keyboard, an internal modem, and all the I/O ports you've come to expect from a mainstream PC (and hence is not to be confused with the so-called ultraportables described below). This machine is mere steps behind our perfect presentation portable, with its core hardware including a Pen-

tium II processor, 64MB of memory, a graphics controller with 2MB of memory, and a 6GB hard disk. Since this system can't house I/O drives, you may need—in addition to a docking station for use at home or in the office—a CD-ROM drive and a floppy disk drive that connect to the main machine via cables.

Whether you opt for a such a system or a larger presentation portable, make sure the manufacturer offers a three-year parts-and-labor warranty, a year of telephone-based technical support, and—as almost all do—a lifetime of Web-based technical support. Preferably, the warranty should include the promise of on-site service and a 48-hour turnaround on all machines mailed in for repair. An added bonus is "emergency roadside assistance": Some vendors will deliver a new notebook to you the next business day—anywhere in the country—should your machine break down during an important trip.

If you can put up with a smaller keyboard, an ultraportable is worth a look. This is typically less than an inch thick—



Presenters will want a 5- to 7-pound projector and compact speakers.

HAND-HELD COMPANIONS

● **HAND-HELD DEVICE:** monochrome LCD screen, Palm OS, PIM applications, docking cradle with a serial connection to the PC **1**

8 ounces, \$400

● **PALM-SIZE PC (P/PC):** color LCD screen, Windows CE, PIM applications, audio and video capabilities, Compact Flash slot, headphone jack **2**

9 ounces, \$500

● **JUPITER-GLASS H/PC:** color LCD screen, touch pad, Windows CE, PIM applications plus lite version of Word, Excel, Power Point, Outlook **3**

2.5 pounds, \$1,000



the ultraportable—in the vicinity of \$2,000, the mini-notebook uses a Pentium MMX processor and caters to a very small, particular audience.

Hand-Helds and Palmtops

A much broader audience has been reached by today's hand-helds, including PalmPilot devices and Windows CE machines. Developed by the Palm Computing Division of 3Com, Palm devices indeed fit in the palm of your hand and weigh a mere 6 ounces or less, integrating a monochrome LCD and operating on two triple-A batteries. Loaded with the latest proprietary Palm OS, these systems run PIM (personal information manager) applications (address book, calendar, task list, and so on) and a wide range of tools from third parties, many of which are available over the Web. Via an accompanying stylus, you can quickly and easily enter data.

Starting around \$400, these simple devices are meant to be used in tan-

sometimes as thin as 0.5 inches—and under 3 pounds. It differs from the road warrior in that its key size is slightly less than the standard 19 mm, and I/O options are limited. If you wish to use a serial, parallel, VIA, or PS/2 port with your ultraportable, you'll probably need a separate port replicator.

Naturally, an ultraportable can't house floppy disk, CD-ROM, or other drives, and its screen's diagonal is roughly just 11 inches. Most models use older Pentium MMX processors, and their battery lives are quite short. Nonetheless, these machines run Windows 98 like common desktops, offer PC Card slots, and are cleverly put together. Many a user is attracted by their novelty alone.

Then there's the mini-notebook, which isn't as thin as an ultraportable but has a much smaller footprint. Best described as a bulky hand-held that runs Windows 95 or 98 (rather than Windows CE or another hand-held OS), a mini-notebook is ideal if you just want a portable companion for answering e-mail and writing the occasional memo. Because of its small footprint, its screen and keyboard are typically even smaller than those of most ultraportables. Of course, I/O ports are limited on this machine as well, but it always includes a PC Card slot. Priced—like

dem with your desktop PC. An included docking cradle connects to your desktop's serial port and lets you easily transfer data to and from your PalmPilot, including e-mails and expense reports, as well as PIM files.

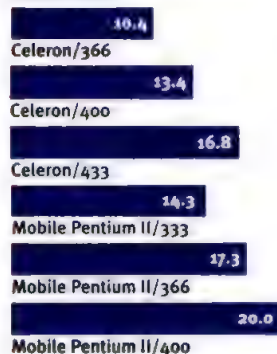
3Com recently launched the Palm VII—which allows for wireless e-mailing and limited Web access—in the New York area, but until this reaches a nationwide audience and undergoes a few months of trial we recommend the Palm IIIx, which offers 4MB of memory and reverse backlighting (when the display's backlight is on, letters and icons light up and the background gets darker, allowing for greater visibility in dimly lit environments).

If you'd rather have a color display or an OS that mimics the desktop versions of Windows, you can choose from the market's myriad Windows CE machines, which aren't as popular as PalmPilot-type devices but are gradually gaining ground. Though vendors still sell lesser Windows 2.0 devices—many with monochrome displays—the newest Windows CE machines are divided into two major categories: Windows CE hand-held PCs (H/PCs) and Windows CE palm-size PCs (P/PCs). Like PalmPilot-type devices, these are meant to be used in tandem with your desktop, linking to its serial port.

Comparing Mobile System Performance

Here are the average scores for typical mobile configurations based on these processors.

ZD BUSINESS WINSTONE 99 (64MB RAM)

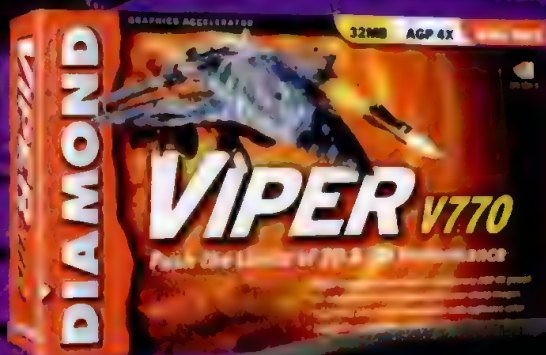


BETTER>

The fastest family of graphics accelerators

just produced an explosive new offspring.

Want to experience screen-shattering speed? Get Diamond's Viper V770 — the latest graphics card with blistering NVIDIA RIVA TNT2 speed. Propelling nearly 9 million triangles every second, it sends images and video exploding across your monitor. Even more kick comes from 32MB of memory, AGP 4X power, higher 32-bit Z/stencil buffer, and complete DirectX and OpenGL support. So it easily fuels the most demanding business, gaming, and Internet applications. And frankly, it blows everything else away.



DIAMOND

MULTIMEDIA

www.diamondmm.com

AUDIO

GRAPHICS

COMMUNICATION

MOTHERBOARDS

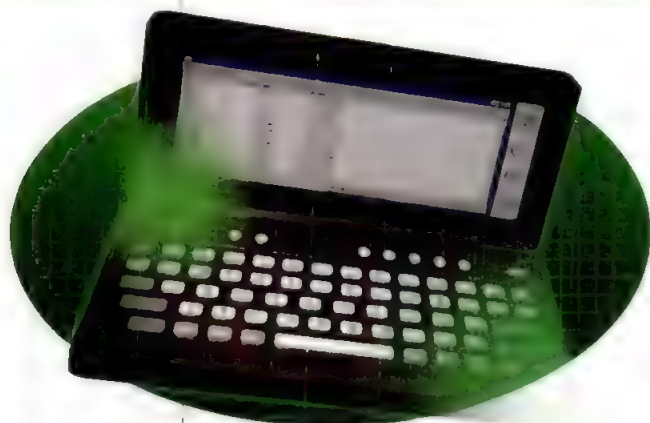
Mobile User Service and Support Policies

	Vendor grade*	Money-back guarantee	Technical support hours (eastern time)	Free telephone support	Technical support Web site	Standard warranty on parts/labor	On-site service for first year	Contact for on-site service within 4 hours	Average turnaround time for PC repair	Shipping paid	Overnight exchange option for users on the road	Orders accepted via the Web	Order tracking via the Web	Custom Web pages for volume customers	Web support according to model	E-mail notification of driver updates
Acer	C	Varies with dealer	24 hours, 7 days	1 year	AcerSupport.com	1 year/1 year	N/A	N/A	1-2 days	Both ways	X	✓	✓	X	✓	X
Apple	C	Varies with dealer	7:00-7:00 M-F	90 days	www.apple.com/support	1 year/1 year	N/A	N/A	3 days	Both ways	X	✓	✓	✓	✓	✓
Compaq Armada	B	30 days	24 hours, 7 days	Lifetime	www.compaq.com/support	3 years/3 years	Included	3 years, \$499	2 days	Both ways	✓	✓	X	✓	✓	✓
Compaq Presario	B	Varies with dealer	24 hours, 7 days	1 year	www.compaq.com/athome/support	1 year/1 year	N/A	N/A	48 hours	Both ways	X	✓	✓	X	✓	✓
Compaq Prosignia	B	30 days	24 hours, 7 days	Lifetime	www.compaq.com/support	3 years/1 year	Included	N/A	48 hours	Return only	X	✓	✓	X	✓	✓
Dell Latitude	B	30 days	24 hours, 7 days	Lifetime	www.dell.com/support	Varies	Included	N/A	Next day	N/A	X	✓	✓	✓	✓	✓
Dell Inspiron	B	30 days	24 hours, 7 days	Lifetime	www.dell.com/support	3 year/3 years	Included	N/A	Next day	Both ways	X	✓	✓	✓	✓	✓
Fujitsu	C	Varies with dealer	24 hours, 7 days	Warranty period	www.fujitsu.com/selfhelp/fm.html	Varies	\$49.95	N/A	2 days	Both ways	X	✓	✓	X	✓	✓
Gateway	B	30 days	24 hours, 7 days	Lifetime	www.gateway.com	Varies	\$79	N/A	Next day	Return only	X	✓	✓	✓	X	X
HP	C	30 days	24 hours, 7 days	Warranty period	www.hp.com/cposupport/nonjsnav/omnibook.html	Varies	\$179	N/A	48 hours	Both ways	X	✓	✓	✓	X	✓
IBM	A	Varies with dealer	24 hours, 7 days	Warranty period	www.pc.ibm.com/support	Varies	\$49	1 year, \$49	2 days	Both ways	X	✓	X	✓	✓	✓
Micron	B	30 days	24 hours, 7 days	Lifetime	support.micronpc.com	3 years/3 years	N/A	N/A	3 days	Both ways	X	✓	✓	✓	X	X
NEC	C	30 days	24 hours, 7 days	3 years	www.nec.computers.com	3 years/3 years	\$99	\$199	24 hours	Both ways	✓	✓	✓**	✓	✓	✓
Sony	A	Varies with dealer	24 hours, 7 days	1 year	www.itsa.sony.com/support/pc	1 year/1 year	Included	N/A	7-10 days	Both ways	X	✓	✓	X	✓	X
Toshiba	B	Varies with dealer	24 hours, 7 days	Warranty period	www.toshiba.com	Varies	Varies	N/A	Varies	Both ways	✓	X	X	✓	✓	✓
WinBook	D	30 days	8:00a-9:00p M-F, 9:00-4:00 Sat.	Lifetime	www.winbookcorp.com	1 year/1 year	N/A	N/A	4 days	Return only	X	✓	✓	X	✓	✓

* Based on PC Magazine's 1999 Service and Reliability Survey

N/A—Not applicable: The vendor does not offer this service.

** Large accounts only.



Original H/PC: Color LCD touch screen, Windows CE, and lite version of desktop apps.

H/PCs vary in size, ranging from the familiar "clamshell" units to more notebooklike devices, which—at 2 or 3 pounds—are often heavier than many ultraportables. Typically priced between \$800 and \$1,000, these systems offer minimal versions of Word, Excel, PowerPoint, the e-mail client Outlook, and Internet Explorer, as well as several standard PIM applications. Most units use touch screens that let you navigate the OS with a stylus, but some integrate touch pads instead. All are equipped with undersize keyboards.

Obviously, these devices aren't as powerful as full-size notebooks, but H/PCs turn on instantly and can operate for days on battery power. We recommend a smaller unit à la LG Electronics' Pphenom Express, but larger machines in the vein of the HP Jornada 820 include much larger displays (up to 6 by 8 inches) and

The iiyama TrueFlat series. See, and feel, the difference.

The addition of the TrueFlat series to the award-winning family of monitors from iiyama is really something to see. Experience for yourself the benefits of these new, flat screen monitors. This advanced technology brings to you a brighter, sharper image that reduces the stress, and strain, on your eyes.

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VisionMaster Pro 410 - \$469 ESP
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Horizontal frequency 27-80khz

VisionMaster Pro 450 - \$699 ESP
Resolution 1800 x 1440 @ 80hz
AG pitch 0.25mm center
Horizontal frequency 30-115khz

VisionMaster Pro 510 - \$1229 ESP
Resolution 2048 x 1536 @ 80hz
AG pitch 0.25mm center
Horizontal frequency 30-130khz

CRT Monitor Model/ Viewable Area	TCO	Dot Pitch/ CRT Type	Max. Horizontal Scan Rate	Max. Resolution	Est. Street Price
22" VisionMaster Pro 510 (20.0" VIS)	TCO '99	0.25mm/AG	130khz	2048 x 1536 @ 80hz	\$1229
21" VisionMaster Pro 502 (19.5" VIS)	TCO '95	0.28mm/AG	110khz	1800 x 1440 @ 75hz	\$999
VisionMaster Pro 501 (19.5" VIS)	TCO '95	0.28mm/AG	96khz	1600 x 1200 @ 75hz	\$939
VisionMaster 502 (19.5" VIS)	TCO '95	0.22mm/H	110khz	1800 x 1440 @ 75hz	\$999
18" VisionMaster Pro 450 (18.0" VIS)	TCO '99	0.25mm/AG	115khz	1800 x 1440 @ 80hz	\$699
VisionMaster 450 (18.0" VIS)	TCO '95	0.22mm/H	102khz	1600 x 1200 @ 80hz	\$559
17" VisionMaster Pro 410 (16.0" VIS)	TCO '99	0.25mm/AG	96khz	1600 x 1200 @ 75hz	\$469
VisionMaster Pro 400 (16.0" VIS)	TCO '95	0.25mm/AG	96khz	1600 x 1200 @ 75hz	\$399
VisionMaster 400 (16.0" VIS)	TCO '95	0.26mm/dp	96khz	1600 x 1200 @ 75hz	\$379
1702BT (16.0" VIS)	TCO '95	0.28mm/dp	96khz	1280 x 1024 @ 65hz	\$299
15" VisionMaster 350 (13.7" VIS)	MPR-II	0.28mm/dp	69khz	1280 x 1024 @ 65hz	\$219
TFT/LCD Monitor Model	TCO	Pixel Pitch	Max. Horizontal Scan Rate	Max. Resolution	Est. Street Price
14.1" Pro Lite 36a (with OSD)	TCO '95	0.297mm	62.5khz	1024 x 768 @ 75hz	\$839
15.0" Pro Lite 38a (with OSD)	TCO '95	0.297mm	62.5khz	1024 x 768 @ 75hz	\$1079
Pro Lite 38b (with OSD, USB & Speaker)	TCO '95	0.297mm	62.5khz	1024 x 768 @ 75hz	\$1129
15.4" Pro Lite 39a (with OSD, USB & Speaker)	TCO '99	0.2385mm	80khz	1280 x 1024 @ 75hz	\$1999
15.1" Pro Lite 48a (with OSD, USB & Speaker)	TCO '99	0.2805mm	80khz	1280 x 1024 @ 75hz	\$3329

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1998
VisionMaster 450



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VisionMaster 450



January 1999
VisionMaster 450



January 6, 1998
VisionMaster Pro 17



October 6, 1998
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August 1998
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Feb. Mar. Apr. & May 1999
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User Tips

- ✓ **Watch the screen size.** A 14- or 15-inch panel adds significant weight. Worse, when you fly coach and the discourteous soul in front of you reclines all the way, you won't be able to open the machine completely.
- ✓ **Buy that battery.** Unless the standard one lasts a cross-country flight, you'll need it.
- ✓ **Save a slot.** Consider a machine with built-in Ethernet. That will leave your PC Card slot free for other devices.
- ✓ **Online backup.** Subscribe to an on-line back-up service (about \$20 a month). That way, if your machine is stolen or breaks down, you won't lose all your hard work.
- ✓ **Why choose?** Can't decide between a touch pad and a pointing stick? Some laptops offer both.
- ✓ **Keep it safe.** Buy a Kensington Lock and use it when you leave the machine in a hotel room overnight. Port and others make audible alarms that draw attention to thieves.

larger keyboards (up to 18.1 inches). Do make sure, however, that your device offers a built-in 56.6-Kbps modem, a Compact Flash slot, and a PC Card slot—if not a VGA port.

Typically weighing 9 ounces and measuring a mere 5 by 3 by 1 inches, P/PCs resemble Palm Pilot devices, but are much more potent. Though they lack the Pocket Internet and business applications of the H/PCs, you can typical-

ly use them to view high-quality images, listen to music, and play back video files—not to mention store PIM data. We recommend a model with a 16-bit, 65,000-color display, a stereo headphone jack, and a Compact Flash slot. These machines aren't as simple as the 3Com units—and don't load applications as fast—but as far as multimedia devices go, they're uniquely portable and inexpensive, typically selling for around \$500.

What You Get from the Top Companies

Acer America Corp. Though Acer America still sells a few inexpensive notebooks from the Extensa line, its primary portable line is the TravelMate series, offering four distinct models for professional users. Acer purchased both lines from Texas Instruments. Acer sells primarily through traditional and Internet-based resellers. Headed by the TravelMate 720—an 8-pound Pentium II machine with a 14.1-inch screen, an integrated floppy disk drive, and a bay for additional drives—the line also includes a thin, 4-pound system (the TravelMate 330), a 3-pound mini-notebook with a smaller-than-normal keyboard (the TravelMate 310), and a full-size but inexpensive model (the TravelMate 510).

Acer resellers will occasionally provide on-site service to large customers, but the company's standard one-year warranty requires that you send your machine back to Acer for repairs. The company's Web-based support is mediocre at the moment, but this should improve when AcerSupport.com is launched this summer. (San Jose, CA; 800-733-2237; www.acer.com/aac.)

Apple Computer Inc. Now available with a 400-MHz PowerPC G3 processor—capable of competing with the leading Mobile Pentium II chip—the Apple PowerBook G3 is a reasonably light yet potent machine. From a sleek, 1.7-inch-thick chassis, it offers a 14.1-inch display, a removable CD-ROM or DVD drive, USB ports, built-in 10/100 Ethernet and a 56.6K modem, and a 10GB hard disk.

Apple backs each PowerBook with a one-year warranty and no on-site service. Yet the Apple Web site serves up an abundant and well-organized database of support tools. The site is also a means of purchasing PowerBooks. (Cupertino, CA; 800-795-1000; www.apple.com.)

Compaq Computer Corp. Compaq's mobile systems span nearly every significant market seg-

ment. Available through resellers and—to varying degrees—directly from Compaq, these systems offer fairly generous service policies.

Meant for small and growing businesses, the Compaq Prosignia notebook line includes the Pentium II-based Prosignia 100, equipped with a CD-ROM or DVD drive as well as a bay for other devices, and the inexpensive AMD K6-2-based Prosignia 150, which has a fixed floppy disk drive in place of the 100's drive bay. Meanwhile, Compaq's corporate line—Armada—runs the gamut from a beefy presentation laptop down to a svelte 4-pound ultraportable.

The Presario line of home notebooks is exquisitely designed, often providing brilliant stereo sound. Compaq also offers two handheld devices: a palm-size Windows CE device known as the Aero 2100 and a 7-inch-long Windows CE “clamshell” known as the C-Series. (Houston; 800-345-1518; www.compaq.com.)

Dell Computer Corp. Dell notebooks are divided into two lines: one for corporate users and one for power users or small- and home-office environments. The latter, known as Inspiron, is itself divided into two subgroups, offering the hefty Pentium II-based Inspiron 7000 and the smaller Celeron- and Pentium II-based Inspiron 3500. Naturally, the 7000 is the more expensive model, integrating a CD-ROM or DVD drive, a floppy disk drive, and in some cases a 15-inch display.

The Dell Latitude corporate network line—analogue to the company's OptiPlex desktop line—includes a 3.1-pound ultraportable (the Latitude LT), a 6-pound Pentium II portable (the Latitude CPi), and a similar Celeron model (the Latitude CPT). The latter two are classic, rugged, reliable corporate machines, available with 10/100 Ethernet adapters and Windows NT.

With Latitudes, Dell's warranty promises three years of parts and—remarkably—three years of on-site service. In fact, Dell will send a

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AND CONNECTIONS
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The Dell Precision® Workstation, with Intel® Pentium® III processor, is the ultimate work and design graphics. Designed for high-performance and memory-intensive applications, it handles a wide range of complex calculations, such as CAD and 3D animation. If you're searching for a desktop built for a particular community, the Dell OptiPlex® is ideal. Designed for network stability, easy upgrading and integrating peripherals makes this one a good choice. Lastly, the Dell Dimension® line has the same of the latest processor and functional technology to meet your office applications in a price that's surprisingly low.

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- Long Product Lifecycles for Network Stability
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- Sound Blaster Pro Compatible Sound
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- Remote Client Manageability Support via DMI 2.0; Remote Wakeup
- MS Windows NT Workstation 4.0
- 3-Year NBD On-site³ Service
- ★ *Call about Our Small Business Series featuring MS Office 2000 Products.*

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 **E-VALUE CODE: 04107-390615**

DELL OPTIPLEX G1 400L

Network-Optimized Desktop

- Intel® Celeron™ Processor at 400MHz
- Tool-Free Opti-Frame Low-Profile
- Long Product Lifecycles for Network Stability
- 64MB SDRAM
- 4.3GB⁴ SMART Ultra ATA Hard Drive
- 15" (13.8" vis) 800F Monitor
- 2MB ATI RAGE IIC AGP Graphics
- 32X Max⁵ Variable CD-ROM Drive
- 3Com Fast EtherLink XL 10/100
- Remote Client Manageability Support via DMI 2.0; Remote Wakeup
- MS Windows NT Workstation 4.0
- 3-Year NBD On-site³ Service
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- HP SureStore CD-Writer Plus 7500E, add \$324.
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- 16MB Diamond Viper nVidia TNT AGP Graphics Card
- 40X Max⁵ Variable CD-ROM Drive
- Turtle Beach Montego II A3D™ 320V Sound Card
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- 3Com 3C905C-TXM 10/100 NIC
- 100MB Iomega Zip BUILT-IN Drive
- MS Office 2000 Small Business plus Bookshelf 2000; McAfee VirusScan
- MS Windows® 98
- 3-Year Limited Warranty²
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 **E-VALUE CODE: 04107-590622**

DELL DIMENSION XPS T450

High Performance, High Value

- Pentium III Processor at 450MHz
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- 9.1GB⁴ Ultra ATA Hard Drive
- 17" (16.0" vis, .26dp) M780 Monitor
- 8MB ATI XPERT 98D 3D AGP Graphics
- 40X Max⁵ Variable CD-ROM Drive
- Yamaha XG 64V Wavetable Sound
- harman/kardon HK-195 Speakers
- 3Com 3C905C-TXM 10/100 NIC
- 100MB Iomega Zip BUILT-IN Drive
- MS Office 2000 Small Business plus Bookshelf 2000; McAfee VirusScan
- MS Windows 98
- 3-Year Limited Warranty²
- 1-Year NBD On-site³ Service
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- 40X Max⁵ Variable CD-ROM Drive
- SoundBlaster 64V Sound
- Intel 10/100 Ethernet Controller
- Microsoft® Works Suite 99 with Money 99 Basic; McAfee VirusScan
- MS Windows 98
- 3-Year Limited Warranty²
- 1-Year NBD On-site³ Service
- ★ *Add \$189 to Upgrade to: Dimension L433c with Intel Celeron Processor at 433MHz, 64MB SDRAM, MS Office 2000 Small Business.*

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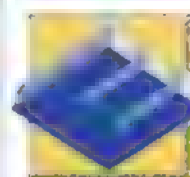
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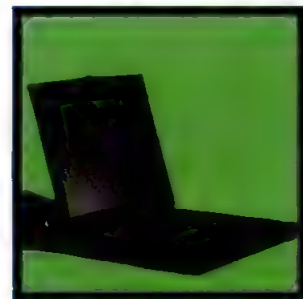
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- NEW 14GB⁴ Ultra ATA Hard Drive
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- 3D Surround Sound and Wavetable
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- 32MB SDRAM
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- Modular 24X Max⁷ Variable CD-ROM
- NeoMagic® MediaMagic™ 256AV AGP Video
- 3D Surround Sound and Wavetable
- Lithium Ion Battery
- MS Works Suite 99 with Money 99 Basic; NEW McAfee VirusScan
- Microsoft Windows 98
- 3-Year Limited Warranty²
- ★ Upgrade to 64MB SDRAM, add \$99.
- ★ Inspiron 3500 Port Replicator, add \$139.

\$2249

Business Lease¹⁵: \$75/Mo., 36 Mos.

 **E-VALUE CODE: 04108-890622**

DELL INSPIRON 3500

Light Weight, Light Price

- Intel Celeron Processor at 366MHz
- 14.1" XGA Active Matrix Display
- 32MB SDRAM
- NEW 4.8GB⁴ Ultra ATA Hard Drive
- Modular 24X Max⁷ Variable CD-ROM
- NeoMagic MediaMagic 256AV AGP Video
- 3D Surround Sound and Wavetable
- Lithium Ion Battery
- MS Works Suite 99 with Money 99 Basic; NEW McAfee VirusScan
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Business Lease¹⁵: \$60/Mo., 36 Mos.

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DELL LATITUDE C/Pi

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- 13.3" XGA Active Matrix Display
- 96MB SDRAM
- NEW 4.8GB⁴ Ultra ATA Hard Drive
- Modular 24X Max⁷ Variable CD-ROM
- Modular Floppy Drive
- NeoMagic MediaMagic 256AV AGP Video
- 3D Surround Sound and Wavetable
- Lithium Ion Battery with 1-Hour ExpressCharge™ Technology
- Microsoft Windows NT Workstation 4.0
- 3-Year NBD On-site³ Service
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Business Lease¹⁵: \$107/Mo., 36 Mos.

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Network-Optimized Notebook

- Intel Celeron Processor at 333MHz
- 14.1" XGA Active Matrix Display
- 32MB SDRAM
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DELL NOTEBOOK AWARD INFORMATION

- Inspiron 7000 A366LT – PC Magazine's Editors' Choice for small businesses, 2/99.
- Inspiron 7000 A366LT – PC World's Top 10 Power Notebooks, 4/99.
- Inspiron 3500 C300XT – PC World's Best Buy in the budget category, 6/99.
- Latitude C/Pi A366XT – PC World's #1 Best Buy Power Notebook, 6/99.
- Latitude C/Pi Series 366XT – 5-Time Survivor of PC Computing's Annual Torture Test, 3/99.
- Latitude C/Pi Series D300XT – PC Computing's #1 Best Buy Power Notebook, 3/99.
- Latitude C/Pi Series A366XT – May Windows Magazine List Fastest Performance, 5/99.

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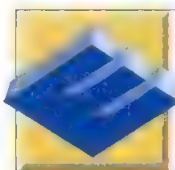
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- Canon BJC-50 Portable Printer, add \$349.
- Infocus LP 400 Ultra Portable Projector, add \$3025.
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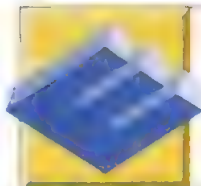
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Business Lease¹⁵: \$420/Mo., 36 Mos.

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- Intel Pro/100+ PCI Ethernet Adapter
- Integrated Ultra-2/LVD and Ultra/Narrow SCSI Controllers
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- Princeton 15" Monitor, add \$229.
- HP LaserJet® 1100SE, add \$399.
- 3Com OfficeConnect ISDN LAN Modem, add \$406.

DELL POWEREDGE 2300 SERVER (DUAL PROCESSOR/RAID CAPABLE)

Workgroup Server

- Pentium II Processor at 400MHz
- 64MB 100MHz ECC SDRAM
- 4GB* Ultra-2/LVD SCSI Hard Drive (Hot-Swap Optional)
- HP OpenView NNM Special Edition
- Intel Pro/100+ PCI Ethernet Adapter
- Integrated Ultra-2/LVD and Ultra/Narrow SCSI Controllers
- 6 Expansion Slots: 4 PCI, 2 PCI/ISA
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- 4GB* Ultra-2/LVD SCSI Hard Drive
- HP OpenView NNM Special Edition
- Intel Pro/100+ PCI Ethernet Adapter
- Integrated PCI Ultra-2/LVD SCSI Controllers
- 6 Expansion Slots: 5 PCI, 1 PCI/ISA
- 4 Hard Drive Bays: 2-1.6" and 2-1"
- Media Bays: 3-5.25"
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- 7x24 Dedicated Server Hardware Telephone and Online Technical Support
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TODAY TO CUSTOMIZE
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DELL SERVER AWARD INFO

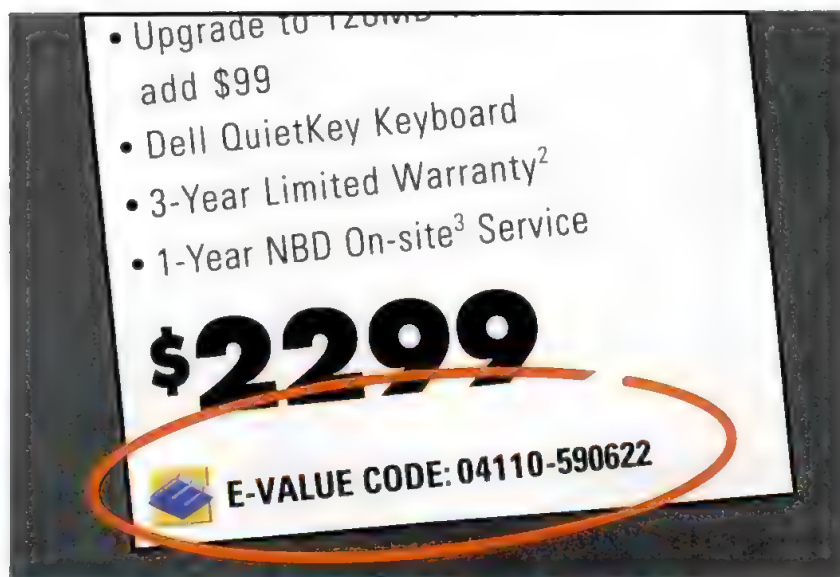
- *Network Magazine* "1999 Products of the Year" — Dell PowerEdge 2300 (Workgroup Server), 5/99.
- *Network World* "World Class Award" — Dell PowerEdge 2300, 6/98.
- *Computer Shopper* "Top 100" — Dell PowerEdge 2300, 11/98.
- *PC Computing's* "The 'A' List" — Dell PowerEdge 6300, 11/98.
- *LANTimes* "The Best of LANTimes Over \$25,000" — Dell PowerEdge 6300, 9/98.
- *Computer World* "1998 Leaders' Choice" — Workgroup Servers Dell PowerEdge Family, 1/98.

Advertised configurations vary from award-winning configurations.

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technician to your location the following business day. Inspiron warranties—typically for three years—require that you send malfunctioning machines back to Dell during your second and third years of ownership, with Dell paying for shipping. Dell provides excellent support tools on its public Web site and custom, private Web pages for large customers. (Round Rock, TX; 800-388-8542; www.dell.com.)

Fujitsu PC Corp. Though most of Fujitsu's business is done via resellers and retailers, three of its four major notebook lines are now sold over the Web or by telephone. The only machine not sold online is the Fujitsu E Series, a 7-pound portable offering a 12.1- or 13.3-inch display and two drive bays for use with removable hardware. The company also sells a 4.5-pound ultraportable (the L Series), a 2.7-pound mini-notebook with a reduced keyboard (the B Series), and an inexpensive 8-pound model integrating both floppy disk and CD-ROM drives (the C Series).

The L Series is backed by a three-year parts-and-labor warranty; all other models are covered for only one year. If you're willing to pay additional fees, Fujitsu will supply on-site service or guarantee a two-day turnaround on machines mailed in for repair. There's even a plan that lets you replace your display up to twice a year. (Milpitas, CA; 888-466-8434; www.fujitsu-pc.com.)

Gateway Inc. The Gateway notebook line includes four distinct machines, each with a full-size keyboard and all the common I/O ports. The company does not offer a sub-3-pound mini-notebook or an ultraportable—which typically have small keyboards and limited I/O—but its Solo 3150 portable is 1.2 inches thick and only 5.2 pounds, offering a Pentium II processor, a 12.1-inch display, and an integrated DVD drive. The Solo 5150 integrates a 14.1-inch display, but it too is quite thin (1.6 inches) and light (6.7 pounds). Gateway also offers the Solo 9150 (a large desktop replacement) and the Solo 2500 (an inexpensive model with an impressive set of components).

Whereas the 2500 and 5150 have one-year warranties, the other two models are backed by a full three years of service, with Gateway paying for return shipping each time you send a system in for repair. Each of these notebooks is available directly from Gateway's newly revamped Web site (which provides an excellent technical-support page) over the phone, or from one of the company's 155 country stores. (North Sioux City, SD; 800-315-2536; www.gateway.com.)

Hewlett-Packard Co. Hewlett-Packard offers its portables solely through resellers. You can use the company's Web site to make a purchase, but once you've chosen the systems you wish to buy, the site merely points you to an online reseller or posts a reseller's phone number. Nonetheless, HP does offer custom Web sites and dedicated support and sales teams for large customers. Warranties vary from machine to machine, but the company now supplies 24-hour, 7-day technical support over the phone and—in some cases—next-business-day on-site service.

The HP OmniBook 4150 high-performance portable—meant as a desktop replacement—is a 6-pound machine with a 14.1-inch display, dual pointing devices, and a front drive bay compatible with several different hardware devices. For those needing a smaller, lighter system, HP offers the 4-pound OmniBook 900, which lacks the 4150's integrated drive bay and uses a 12.1-inch display. The modest OmniBook XE2 occupies the lower end of the market, integrating both a floppy disk drive and a CD-ROM drive while using—in some cases—Intel's mobile Celeron chip. HP also sells Windows CE handheld devices under the Jornada name. (Palo Alto, CA; 800-752-0900; www.hp.com.)

IBM Corp. IBM's mobile systems range from a fully featured ThinkPad (\$4,499 direct) to a WorkPad data assistant (\$450 street) or a \$250 pocket-size unit. This year, the value ThinkPad i Series makes IBM notebooks more available to the masses, starting at \$1,600 (street).

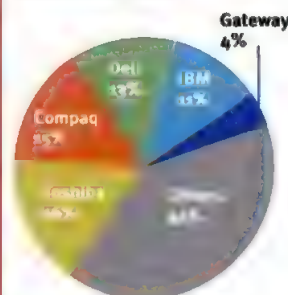
As evidenced by an A on our Service and Reliability Survey, IBM's mobile support is fairly comprehensive. The upper-tier 770, 600, and 570 offer three years of shipping-paid repair service, though the 390, i Series, and older ThinkPads offer only one year. Also, IBM's impressive Owner Privileges program is available for i Series owners.

Impressive ThinkPad features include the Asset ID password-security system and the UltraBase (\$120 street) for the 570 (\$2,699 direct)—a snap-in base unit that provides two extra drive bays, allowing the 570 to function as both slimline system and desktop replacement. (Armonk, NY; 800-426-7225, 914-765-1900; www.ibm.com.)

Micron Electronics Inc. Micron has pared its notebook line down to a pair of distinct, full-size models: The 8-pound corporate model, known as the TransPort NX, includes dual-pointing devices, up to 28GB of storage space, and a 15-

Top 5 Portable PC Vendors

In mobile PC sales, only four vendors can boast double-digit market share.



Figures are 1998 U.S. unit shipments.

Source: International Data Corp., May 1999 (www.idc.com).

THE PERFECT PC FOR THE MOBILE USER



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Your laptop's PC Card slot offers a world of possibilities. This site shows the latest developments—CardBus, miniature, 16-bit, and SmartMedia—as well as a resource directory for PC Card products worldwide.

> Presenter's University

www.presentersuniversity.com

Sponsored by Proxima, a multimedia projector manufacturer, Presenter's University is a site for improving your presentations through courses, a Q&A section, and a multimedia center that offers free templates and clip art.

> 1-800-Batteries, PORT

www.1800batteries.com

www.port.com

Not just batteries but also mobile/PDA gear and gadgets, as well as carrying cases.

inch display. The TransPort Trek2 is smaller and cheaper but still accommodates the latest Pentium II processor, a floppy disk drive, a CD-ROM drive, and a 14-inch screen.

Micron supplies each notebook customer with 30 hours of free Internet access and a year's worth of Web-based computer-related classes. The standard notebook warranty is three years on parts and labor. Micron sells its portables primarily over the phone and over the Web. (Nampa, ID; 888-634-8799; www.micronpc.com.)

NEC Computer Systems Division. NEC's mobile lines include the Versa corporate notebooks, Ready consumer notebooks, and MobilePro Windows CE devices. For corporate clients, the VersaBay, featured on the Versa LX and SX units, adds an additional cross-compatible bay to the two-spindle design of the standard. The MobilePro line comes with a VGA port for monitor or projector connections, and the high-end 800 unit (\$999 direct) comes with a USB port.

NEC's support offerings are complex. Depending on the notebook, you get from one to three years of warranty coverage with overnight parts exchange within three business days, return

freight included. (Boxborough, MA; 888-863-2669, 508-264-8000; www.nec-computers.com.)

Sony Electronics Inc. Meant for consumers with a strong interest in multimedia, Sony's VAIO portables are known for their innovative hardware. The VAIO 505 SuperSlim notebook was the first so-called ultraportable, a 3-pound Windows 98 machine equipped with a reduced keyboard and a magnesium alloy chassis. Sony's other recent triumph is the VAIO C1 PictureBook, an even smaller if slightly thicker machine that integrates an adjustable video camera. Sony also sells a line of common, full-size VAIO portables. Most VAIO notebooks are equipped with iLINK, the company's FireWire port.

Sony's warranty covers these systems for only a year—without providing on-site service—but the company carefully tailors the VAIO line to home users, loading each machine with a simple means of accessing the Internet and a generous collection of image-editing and audio applications. On the Web, Sony not only offers a modest number of support tools—including SOS, a live connection to a Sony technician—but also serves up Club VAIO, a personal help page meant to

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foster an online community of VAIO users. (San Jose, CA; 888-476-6972; www.sony.com.)

Toshiba America Information Systems Inc. Though Toshiba still offers the seminal Libretto mini-notebook (a 2.4-pound Windows 98 or NT machine with a very small keyboard) and the inexpensive Satellite line (modest machines with integrated CD-ROM and floppy disk drives), the success of the company's notebook business is due mostly to the Tecra and the Portégé, two brilliantly designed portables. Available—famously—in thousands of different configurations, the Tecra 8000 is barely 1.7 inches thick and typically weighs under 7 pounds, yet it still includes the latest in Pentium II processing, a spacious hard disk, a display measuring up to 14.1 inches, and a DVD or CD-ROM drive. The Portégé line is now split into two basic models: the 3000 series (an ultraportable with a Pentium MMX processor, a 10.4-inch display, and a bezel that's less than 0.8-inches thick) and the 7000 series (which is slightly thicker and heavier but comes with a Pentium II processor and a larger display).

Sold through resellers as well as retailers, all of these machines include a three-year parts-

and-labor warranty. Toshiba also lets you send malfunctioning machines to a central FedEx depot, where they will be repaired within two days, then sent back to you at no extra cost. (Irvine, CA; 800-867-4422; www.toshiba.com.)

WinBook Computer Corp. WinBook has lately become influential in the value-notebook market. Selling machines directly and through MicroCenter retail stores, the company was the first to offer a full-size notebook for under \$1,000 (available only over the Web). Not all of its machines are that inexpensive, but most are affordable and well built, typically housing both CD-ROM and floppy disk drives as well as integrated modems and both touch pads and pointing sticks. WinBook was also one of the first vendors to use AMD's mobile K6-2 chip, which appears—along with the Pentium MMX—in the company's XL line. This low-end line is followed by the Pentium II-based XLI line and the high-end but still relatively inexpensive XL² line.

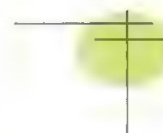
WinBook does not provide 24-hour, 7-day phone support. Its standard warranty is one year, but you can buy a three-year warranty. (Columbus, Ohio; 800-651-4518; www.winbook.com.) 

Most vendors offer

on-site or

24-hour service for an

additional **fee.**



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THE Corporate USER

BUYING SYSTEMS FOR A CORPORATION HAS ITS OWN SPECIAL CHALLENGES. HERE ARE SOME TIPS.

By Jamie M. Bsales and Bruce Brown

You Are...

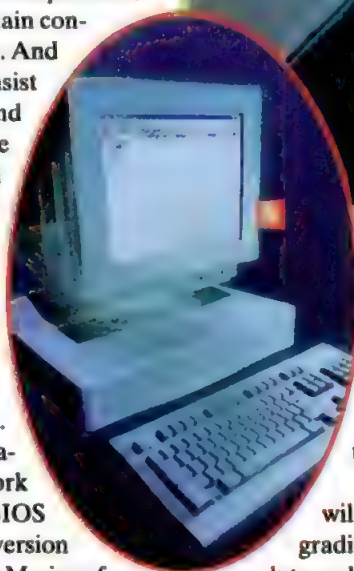
- an IT director charged with specifying machines for the company workforce.
- in charge of purchasing large numbers of systems for workgroups in multiple buildings and office locations.
- looking for ways to reduce time and staff spent traveling to users' desks to troubleshoot PC problems.
- a small-business user looking for a cost-effective PC for typical office chores: word processing, e-mail, spreadsheets, Web access.

AN IT DIRECTOR BUYING THE PERFECT PC for a workforce of several dozen (if not several hundred) has concerns quite different from those of an individual buyer. For one, performance may not be as important as the elements that will make it easier for administrators and their staffs: remote-management capabilities, self-diagnosing machines, chassis designs that make servicing easy, and components, BIOSs, and OS images that remain consistent across lines and over time. And a major corporate buyer can insist on a higher level of service and support than might be available to a single-PC purchaser. All these can lower the total cost of ownership in the long run.

Beyond the Box

The most important part of a corporate PC is the management software that comes with it. This software lets the administrator keep tabs on all the network clients remotely by offering BIOS and hardware information (the version number, amount and type of RAM, size of the hard disk, and so on), user information (who the workstation is assigned to and which group the person is in), and more.

As long as the PC adheres to the Desktop Management Interface standard (or DMI, currently at Version 2.0), the administrator has access to such vital information from his desktop—or from any machine with a Web browser, if the software is Web-enabled. And the client PC can be proactive, sending alerts to the administrator if trouble-causing alert conditions



crop up: an open case, a broken cooling fan, a bad SIMM, even a hard disk that is showing early warning signs of failure. This means IT staff can correct a problem before it brings down a user's machine.

Even the ideal corporate PC will likely need service or upgrading sometime during its tour of duty, so be sure to pay close attention to the machine's physical design. A well-designed chassis lets you or your staff get in and out quickly. We recommend you insist on

- a case that opens with no tools required (though you may want to consider one that locks to keep unauthorized users out);
- drives that slide out with no tools (a single screw holding the hard disk in place is a fair compromise);
- a riser card that slides out to make it easy to access expansion cards and memory;



You Need...

- Pentium III/500 or Celeron/486 processor
- 64MB RAM (128MB for a Windows NT system)
- 8GB to 10GB Ultra DMA/33 hard disk
- 4MB 2-D/3-D graphics accelerator **1**
- 17-inch monitor (0.26-mm mask pitch maximum; 1,024-by-768 resolution at 85-Hz refresh minimum) **2**
- 10/100 Ethernet adapter
- easy-access chassis **3**
- slide-out components **4**
- 32X CD-ROM drive **5**
- Microsoft Windows 98 or NT
- *also: DMI-compliant hardware, basic 16-bit audio with business-audio speakers, remote-management software, three-year warranty, one-year on-site service*

\$2,000

WINDOWS TERMINAL: low-cost processor, 32MB RAM, 2MB video RAM, 2GB hard disk, 10/100 Ethernet adapter, 15-inch monitor, **\$1,000 **6****

HP's Top Tool is currently the best midlevel network management software.

- a motherboard that snaps out easily.

Another factor to investigate is a vendor's policy on component continuity. If you will be rolling out machines to many users over a period of months, you'll want a single OS image and identical (or at least compatible) components, so you won't have to track which machines can and cannot use which BIOSs and spare parts. Several PC makers now use a single motherboard across several chassis designs, which means you can build a single OS image and deploy it to all your machines instead of having to maintain and track several motherboard-specific versions.

Finally, consider a vendor's service and support options (we detail the policies of the leading corporate PC vendors in the accompanying section "What You Get from the Top Companies"). We recommend you look for

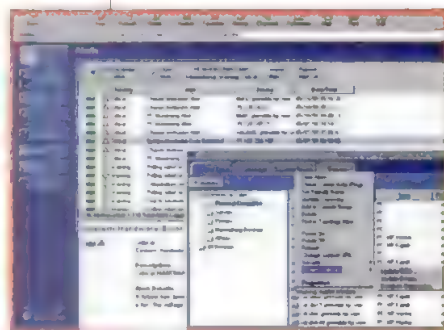
- a minimum three-year warranty, with on-site service handled by a recognized service organization, included for at least the first year (an option for same-day on-site service—typically a

\$200 add-on—is a worthwhile plus);

- Web-based order tracking (and for large accounts, custom Web pages that let you place repeat orders with just a few mouse clicks);
- Web-based support specific to your machines, with driver updates clearly marked. Some vendors (notably Dell) will even automatically notify you via e-mail when they post updates that affect you.

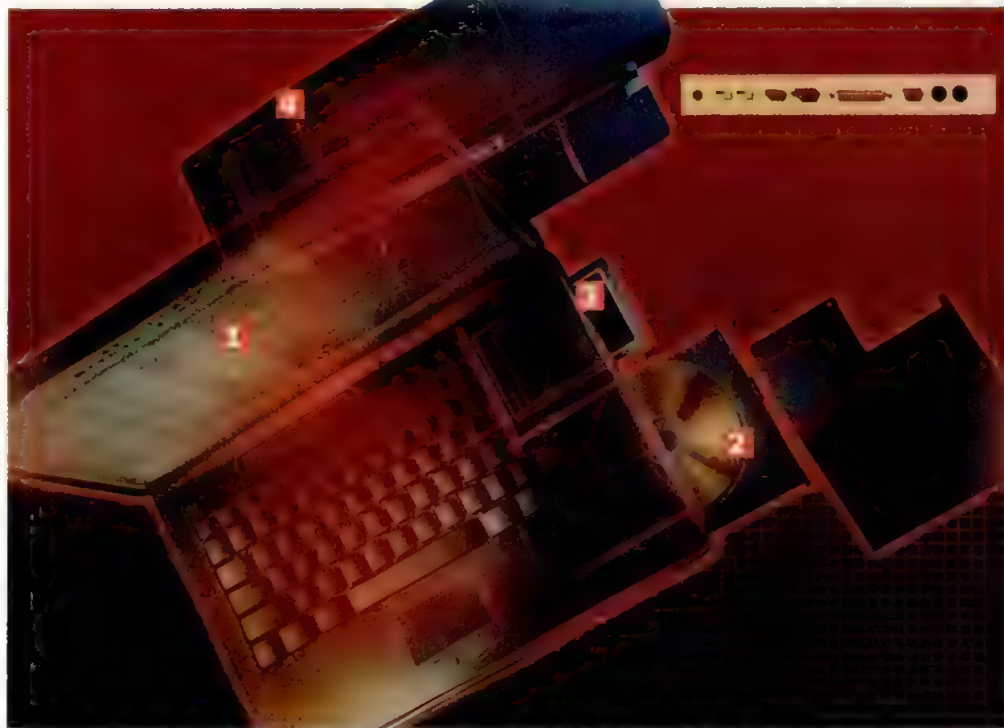
Inside the Box

As we mentioned, performance is not as important in a corporate PC as it is in other classes of machines. In fact, corporate buyers are often better off without cutting-edge (and less field-proven) innards. True, some of your users may need a Pentium III/550 for, say, Web developing or the finance manager's huge spreadsheet recalcs. But your users who use their PCs only for word processing, e-mail, Web



FOR THE ROAD: You Need...

- Celeron/386 or Intel Mobile Pentium II/400 processor
 - 64MB RAM (128MB for Windows NT)
 - 2.5MB to 4MB graphics subsystem
 - 4GB to 8GB hard disk
 - 13- to 14-inch TFT display **1**
 - Internal 56.6K V.90 modem
 - multipurpose drive bay for 24X CD-ROM drive, battery, regular or high-capacity floppy disk drive **2**
 - Type III PC Card slot with Ethernet adapter (if not integrated) **3**
 - port replicator or docking station **4**
 - *also: extra battery, Microsoft Windows 98 or NT, three-year warranty (with a 48-hour repair program and next-day on-site repair), one-year telephone support, lifetime Web support, remote-management and asset-tracking software (DMI- and WTM-compliant), and peripherals, port replicator, and motherboard (common across the line)*
- 7 pounds, \$2,500**



research, and light spreadsheet work will do just fine with a Celeron/466, and you'll save about \$700 per machine over the latest Pentium processor.

As for memory, 64MB of RAM will suffice unless you have deployed Windows NT or plan to migrate to Windows 2000. In such cases, 128MB per machine is what you'll need. You don't need to spend the premium on the fastest 3-D graphics chip for the bulk of your workforce; 3-D apps for the business desktop are still rare. A 4MB subsystem (either on a dedicated card or down on the motherboard) will deliver all the 2-D speed your users need. Up it to 8MB if your budget allows, in case Microsoft surprises us with the killer 3-D app sometime soon. On our testing, we've found that accelerators based on the ATI Rage PRO, the Matrox G200, the nVidia RIVA TNT and Vanta, and the new S3 Savage4 deliver good performance for the price.

We do recommend you upgrade your workforce from 15-inch monitors to 17-inch models. These monitors can run at 1,024-by-768 resolution, and the productivity gains from being able to see more of a document without scrolling will easily offset the \$150 price premium over a 15-inch model. Alternatively, you may want to consider deploying 15-inch LCD monitors (about \$950 apiece) in high-profile areas such as reception desks and corner offices. A 15-

inch LCD model will give users almost the same viewable area as a 17-inch CRT.

Corporate users will be (or at least should be) saving their work to the network server—where it can be kept secure and backed up—so hard disk space on each corporate desktop can be kept to a minimum. In fact, some companies want their users to have very limited desktop storage, to dissuade them from loading games, Web downloads, and other productivity busters. We're not that Scroogelike, but we think any user should be able to make do with a 6GB to 10GB hard disk. Furthermore, corporate desktops don't need fancy removable storage. Consider a high-capacity floppy disk drive (such as an Iomega Zip Drive, Imation SuperDisk, or Sony HiFD) only for users who have to share or transport large files. For most others, the standard floppy disk drive will do.

Likewise, we've found that most corporate machines don't yet need DVD-ROM. We recommend a 32X or better CD-ROM drive. Do note that we have found performance differences between standard "32X max" drives and those equipped with Zen Research's TrueX technology. By reading multiple tracks simultaneously while spinning the CD at a reasonable speed, a TrueX drive can maintain close to 32X performance throughout the disk surface for sequential data transfers. Standard drives need to spin down to slower speeds on the data-

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intense inner tracks. We measured a 10 percent performance advantage for a TrueX-equipped drive, and since the cost difference is only about \$15, the investment might make sense for some installations.

Mobile Users

For the mobile machines in your corporate arsenal, the same priorities apply as for the desktops. You'll want full manageability and tracking, as well as generous service and support. You'll also want to check that a manufacturer uses the same peripheral components—batteries, removable drives, port replicators, docking stations—up and down the model line, and ideally from one generation to the next. You don't want to have to maintain an inventory of disparate components.

We recommend a two-spindle machine (that is, a model with the hard disk plus one other drive built-in). The secondary drive should be swappable with a CD-ROM drive, a regular or high-capacity floppy disk drive, and a spare battery. Many corporate notebooks are now offering built-in Ethernet adapters, which

we feel is a good option to seek out.

Recommended Software

Windows 95 and Windows NT are the norm in the corporate setting, though any vendor will let you substitute Windows 98. Beyond the operating system and standard productivity apps of an office suite, there are several utilities we recommend to round out the perfect corporate PC: an antivirus package (we prefer Norton AntiVirus), a compression utility (WinZip or ZipIT), and Adobe Acrobat Reader.

Some of your users will also need an image-editing package or an easy-to-use Web publishing app (we like Trellex), but these should be added only on a case-by-case basis.



A corporate machine benefits from slide-out components and a tool-free case.

What You Get from the Top Companies

Acer America Corp. Acer's corporate systems are relatively inexpensive and DMI 2.0-compliant but aren't category leaders in features, performance, expandability, or service options. The AcerPower 6100 and 8000 desktop lines come in easily accessible microtower and mini-tower cases, respectively, with swing-out drive cages for drive and peripheral card upgrades and maintenance. The Extensa 700 notebook series combines a three-spindle design with a modular bay for component switching.

Acer's corporate systems are sold through dealers and VARs. Free 24-hour, 7-day telephone support is available from Acer for the first year of system ownership, but to date the Web-based resources are relatively limited. The company does not offer custom support pages on the Web for volume customers, but you can find and download drivers and documentation via the Internet. (San Jose, CA; 800-733-2237; www.acer.com/aac.)

CompUSA. You can buy CompUSA systems in company retail locations, via in-store "configurator" terminals, by telephone, via the Web, or

through corporate account managers. Although you won't find features that push technology further or advance the field, CompUSA's adherence to standards means you should have few surprises.

CompUSA's grade of C on our Service and Reliability Survey may improve as the company augments its existing programs and develops new services, particularly additional support online, including online documentation, troubleshooting wizards, and custom pages for volume customers. The company has the advantage of handling its own service and support, with 230 service locations in the U.S., but the current average desktop service turnaround is, at four to five days, longer than with most of the competition. (Dallas; 800-294-4727; www.compusapc.com.)

Compaq Computer Corp. Compaq's comprehensive notebook and desktop PC lines for corporate customers are highlighted by serviceability, security, manageability, and worldwide support, with parts-and-labor warranties of three years (some lines come with only one year) with 48-hour turnaround world-

PC EDITORS' HOT LINKS

► Distributed Management Task Force

www.dmtf.org

The information section of the Distributed Management Task Force Web site includes information about the DMTF's Desktop Management Interface (DMI) and Common Information Model (CIM) standards specifications.

► Windows Driver and Hardware Development

www.microsoft.com/HWDdev

This site is a white paper on Wired for Management, an initiative from Microsoft and Intel aimed at reducing computing costs via hardware management.

► Hewlett-Packard TopTools

www.hp.com/topools/

The home page for HP's powerful TopTools software, a modular, Web-based management tool that provides information about devices on your LAN from any location on the network. It is based on industry standards (SNMP, DMI, WMI, and TCP/IP) and is capable of managing any vendor's device that supports these standards.

Corporate User Service and Support Policies

✓ Yes ✗ No	Vendor grade*	Mail-in back guarantee	Technical support hours (Eastern time)	Free telephone support	Technical support Web site	Standard warranty on parts/labor	On-site service handled by	On-site service for first year	Contract for on-site service within a hours	Average turnaround time for PC repair	Shipping paid	Orders accepted via the Web	Order tracking via the Web	Custom Web pages for volume customers	Web support according to model	Email notification of driver updates
Acer	D	Varies with dealer	24 hours, 7 days	1 year	AcerSupport.com	1 year/1 year	Info not available	Varies	None	1-2 days	Varies	✓	✓	✗	✓	✗
Compaq Armada	C	Direct, 30 days; reseller, varies	24 hours, 7 days	Lifetime	www.compaq.com/support	1-3 years/1-3 years	Authorized agent	Included	3 years, \$499	2 business days	Both ways	✓	✗	✓	✓	✓
Compaq Deskpro	C	30 days	24 hours, 7 days	Lifetime	www.compaq.com/support	3 years/1 year	Authorized agent	Included	Varies	2 business days	Return only	✓	✓	✓	✗	✓
CompUSA	—	14 days	24 hours, 7 days	Lifetime	www.compuser.com	3 years/1 year	CompUSA	Included	None	4-5 days	Carry-in service only	✓	✓	✓	✓	✗
Dell	A	30 days	24 hours, 7 days	Lifetime	www.dell.com/support/index.htm	3 years/3 years	Unisys or Wang	Included	\$199	Next day	Both ways	✓	✓	✓	✓	✓
Gateway	B	30 days	24 hours, 7 days	Lifetime	www.gateway.com/support	3 years/3 years	TSS	Included	Included	Info not available	Both ways	✓	✓	✓	✓	✗
Hewlett-Packard	A	30 days	7:30-7:30 M-F	1 year	www.hp.com/go/support	3 years/1 year	HP	Included	Varies	48 hours	Return only	✓	✓	✓	✓	✓
IBM	A	Varies with dealer	24 hours, 7 days	Warranty period	www.pc.ibm.com/support	3 years/1 year	IBM	Included	3 years, \$299	Next day	Both ways	✓	✓	✓	✓	✓
Micron	B	30 days	24 hours, 7 days	Lifetime	support.micronpc.com	3-5 years/3 years	Unisys	Included	None	24-48 hours	Return only	✓	✓	✗	✗	✗
NEC CSD	C	30 days	24 hours, 7 days	3 years	www.nec-computers.com	3 years/3 years	Unisys	\$99	\$199 per year	24 hours	Both ways	✓	✓	✓	✓	✓
Quantex	—	30 days	24 hours, 7 days	Lifetime	www.quantex.com	3 years/1 year	Philips Magnavox	Included	None	24-48 hours	Both ways	✓	✓	✓	✓	✗
Toshiba	C	None	24 hours, 7 days	3 years	www.toshiba.com	3 years/3 years	Unisys	Included	2 years, \$119; 3 years, \$199	Info not available	Return only	✗	✓	✓	✓	✓

* Based on PC Magazine's 1999 Service and Reliability Survey. A dash indicates that a vendor is not represented in our published survey results for 1999. ** Large accounts only.

wide for many models. The Deskpro EN series, based on the NLX motherboard, is Compaq's most manageable desktop line, featuring a tool-free case, smart software system locking, available fingerprint security, and a 12-month stability target on components (often exceeded). Based on the ATX system board, the Deskpro EP series is a cost-effective platform with a convertible case that can be a tower or a desktop.

Compaq PCs are sold both directly and by resellers. Manageability comes in the form of Compaq's Web-based Insight Manager, which currently can oversee only other Compaqs; it's enhanced by the bundled System Software Manager for remote updating of BIOSs and drivers. Compaq receives a C for office computers on our Service and Reliability Survey, but that grade may rise now that the company has implemented its LifeCycle Solutions program, which includes 29 service and support products to help corporate customers plan,

deploy, and manage their office PCs, systems, and peripherals. (Houston; 800-345-1518; www.compaq.com.)

Dell Computer Corp. With a solid A for desktops and a B for notebooks on our Service and Reliability Survey, Dell PCs feature long product life cycles, common components within lines, and slow transitions between models. The Dell OptiPlex desktop PCs emphasize serviceability with consistent chassis and motherboards within lines, all designed for easy access and replacement. The Latitude CPi notebooks share common components such as drivers, docking stations, and AC adapters.

Support and planning features include Dell's ImageWatch, which offers product road maps to aid model transitions; Express Service Codes to access PC-specific drivers, software, and support information; and Dell's Web-based management software, IT Assistant. Customized support for corporate customers

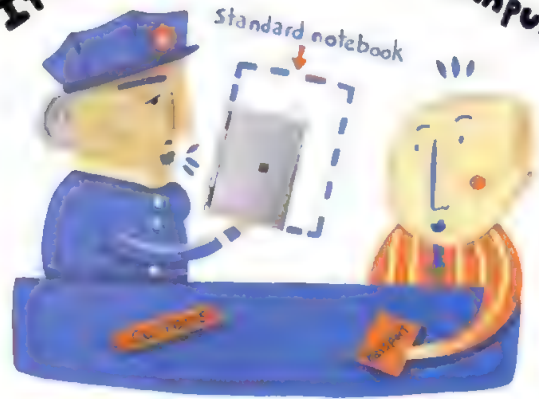




Inconspicuous...



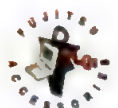
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* Starting estimated street price on B112. Subject to change. * Weight is approximate and may vary.





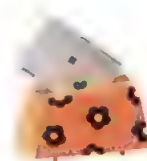
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via the Web rounds out Dell's exemplary service offerings. (Round Rock, TX; 800-388-8542; www.dell.com.)

Gateway. Gateway combines a direct-sales model with VAR Gateway Partners. Its desktop lines include the value-class, Celeron-based E1200 systems; the low-profile E3200 systems, which emphasize serviceability, security, and TCO, with integrated peripherals and easy-to-access components; and the top-of-the-line E4200 platform, which offers a single motherboard in three different cases. The E4200 series is less fully integrated than the E3200 line but lets customers choose their components à la carte to meet performance goals or other specific needs. The Solo 9150 desktop-replacement notebook line, Solo 2500 value line, and Solo 5150 thin and light line share common memory upgrades, docking stations, and AC adapters, substantially lightening the inventory requirements of IT support managers.

Corporate customers can configure PCs online but, unlike the company's retail customers, must phone or fax in their actual orders to safeguard corporate customer system specifications and cost controls. Web-based support—including custom Web pages for corporate customers, troubleshooting wizards, and full online documentation—backs the three-year parts-and-labor warranty standard with all Gateway corporate-market products. (North Sioux City, SD; 800-315-2536; www.gateway.com.)

Hewlett-Packard Co. HP continues to be a leading source for managed desktop PCs, with the highly serviceable Vectra line designed for easy component replacement. A common motherboard within the product line, the ability to remove and replace drives and even the motherboard easily and without tools, and a long product life cycle add to the Vectra's appeal. The company's OmniBook 900 and 4100/4150 corporate notebook lines share common components such as docking stations, modular accessories, and security features, including the same smart cards offered as options with the Vectra line. HP sells via a direct-sales force and

VARs, with Web-based sales support as well.

HP's Web-based network management software, TopTools, is the current premier midlevel package and the only one that in recent testing was able to monitor and manage clients from third-party vendors successfully. HP office systems receive a grade of A in our most recent Service and Reliability Survey, underscoring the value of the company's support. (Palo Alto, CA; 800-322-4772; www.hp.com.)

Many vendors offer custom Web pages for corporate customers.



IBM Corp. IBM's corporate desktop and notebook PCs are backed by a huge worldwide service organization and now include three-year parts-and-labor warranty coverage. Sold via both direct and indirect channels, IBM's desktop corporate models include the PL line, which features a long model transition cycle, Pentium III CPUs, and AGP graphics. IBM also offers the 300 GL line, currently available with processors ranging from Celerons to Pentium IIIs. A 300 PL recently tested was easy to access but did require minimal use of tools to free peripherals (designs from Dell and HP were truly tool-free). The corporate systems ship with a universal management agent for management under standard packages. The popular ThinkPad notebook line sells to corporate customers in many configurations, ranging from the full-powered desktop-replacement ThinkPad 770 to the much-loved, lightweight, 1.4-inch-thick ThinkPad 600 series, which has an average configured weight of 5 pounds.

IBM's array of management services includes AssetID scanning, which lets you use a radio-frequency EEPROM reader to track products. With AssetID, you can log new PCs while they're still in their shipping boxes and keep tabs on them throughout their usage. The desktop products can report chassis intrusion even when their power is off. IBM is also the only company currently providing the means to push OS images onto new network clients. Current customers clearly value IBM's service and support, as indicated by the company's A in this year's Service and Reliability Survey. There are many facets to IBM's service model, including the Notebook Workhorse program, by which the specifications and images of par-

User Tips

- ✓ **Don't overpower.** Only a handful of your users—if any—will be creating 3-D Web content and the like. Buy high-powered machines for the few and right-size PCs for the many.
- ✓ **Don't overspend.** Sexy features like DVD, 3-D audio, and cutting-edge graphics are enticing, but you don't need them in a corporate setting. In fact, they cut into productivity.
- ✓ **Learn to manage.** The management packages that most vendors offer can save you time and money. Learn to use them.
- ✓ **Manage your legacy systems.** Look for management packages that can monitor your legacy systems as well as your new PC purchases. Many a management package offered by a PC vendor works only with systems sold by the same vendor.

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Model	Optique V95	Optique E900	Optique A900
Viewable Image Size	18.0"	18.0"	18.0"
Does Dot Pitch or Better?	Yes	No	No
1,280 x 1,024 @ 68Hz	Yes	No	No
TCO Certified	Yes	Yes	No
PC Magazine Editors Choice	Yes	No	No

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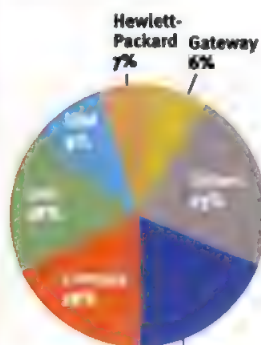
V95

Optique

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Top 10 Corporate PC Vendors

Compaq and Dell are battling it out for the top spot among corporate buyers.



Figures are 1998 U.S. unit shipments.

Source: International Data Corp., May 1999 (www.idc.com).

ticular ThinkPad models are kept stable for a minimum of 9 months. (Research Triangle Park, NC; 800-426-7255; www.ibm.com/pc/us.)

Micron Electronics. Micron's corporate customers benefit from a selection of performance-oriented desktop and notebook computers available for sales directly by telephone and online. A partnership with Unisys provides service, support, and a panoply of added services to help large companies assess and deploy PCs. This program, called MServices, offers everything from desktop installation to on-site multivendor maintenance.

The ClientPro CS managed desktop line, with a mini-tower or full-size tower case and ATX chassis, is the performance choice, with room for a selection of high-speed peripherals. The ClientPro CP's, using Celeron and Pentium II CPUs and MicroATX chassis, are more compact and have less expansion capacity and lower prices. Micron's primary notebook line sold to corporations consists of the TransPort NX desktop-replacement machines, which feature 15-inch displays.

Micron guarantees CPU and system RAM for five years, all other parts for three years, and labor for three years. (Nampa, ID; 888-634-8799; www.micronpc.com.)

NEC Computer Systems Division. NEC notebook and desktop computers are available via a wide variety of channels, including dealers, VARs, online, and, for the Fortune 1000, a direct-sales force. The PowerMate ES desktop series exemplifies NEC's manageability efforts, with a single NLX motherboard that can work with all chassis variations. The Versa SX and LX notebook lines continue the theme of parts universality, sharing modular bay components, memory, and AC adapters.

In recent system management testing, the PowerMate ES proved to be an able network citizen, reporting inventory, status, and health information to both management packages, Intel LANDesk and HP TopTools. NEC, which receives a C in our most recent Service and Reliability Survey, covers all corporate notebook and desktop systems with a three-year parts-and-labor warranty. On-site service is available for \$99 per year, and 4-hour business-day service costs \$199 per year. Custom Web pages with inventory, discount, and selected support content are available for corporate customers. (Mountain View, CA; 888-863-2669; www.nec-computers.com.)

Quantex Microsystems. Corporate customers can buy Quantex PCs online and via dedicated account teams that coordinate to provide both service and sales support. Quantex's SB series of managed desktop machines use a standard PC chassis with an easy-to-open case, though you'll need a screwdriver to remove components. The slimline VX series desktops are best for corporate applications with limited space, incorporating management and network security features. Quantex notebooks available to corporate customers include the T-series—relatively lightweight 1.7-inch-thick notebooks—and the I-series—desktop replacements with 15-inch displays.

In addition to standard three-year-parts, one-year-labor warranties, Quantex backs its systems with customized Web pages, preloaded software bundles, employee purchase programs, asset tracking and inventory management, and order tracking. An online troubleshooting wizard is useful, offering help with hardware, software, and error messages. Drivers and patches are also available online. Quantex does not provide a custom LAN-management solution but supports standard DMI 2.0-compliant packages. (Somerset, NJ; 800-346-6572; www.quantex.com.)

Toshiba America Information Systems. Toshiba's Equium series of desktop PCs come with a variety of cases and CPUs, all standardized on the same NLX motherboard platform. The Equium 7100M line in particular lets you access and replace major components without tools. The powerful Tecra line of desktop-replacement and presentation models has the same three-year parts-and-labor warranty standard with the Equium line. Toshiba does not sell desktop or notebook systems direct, but the company's Web site has links to online and local resellers.

Toshiba ships corporate systems with a wide spectrum of agents and utilities to support and augment major network management environments. While Toshiba receives an overall grade of C on our latest Service and Reliability Survey, the company's Web-based support includes Ask IRIS, an artificial-intelligence-based troubleshooting wizard, and downloadable files and guidance for drivers, patches, and BIOS upgrades. Corporate customers can also set up secure private support pages with account history information and targeted support content. (Irvine, CA; 800-867-4422; www.toshiba.com.) 

THE Home USER

HOME PCs COME IN A HOST OF FLAVORS,
AND PRICES RANGE WIDELY.

By Jamie M. Bsates and Mary E. Behr

You Are...

- buying a primary PC for your family for a variety of tasks: Web surfing, game playing, home finance, or working at home.
- looking for a PC for a parent or grandparent so you can be in touch via e-mail.
- in the market for a bare-bones PC to get on the Internet for the lowest cost.
- putting together a killer game system.
- thinking about an affordable, portable PC that can be taken to school or on the occasional trip.

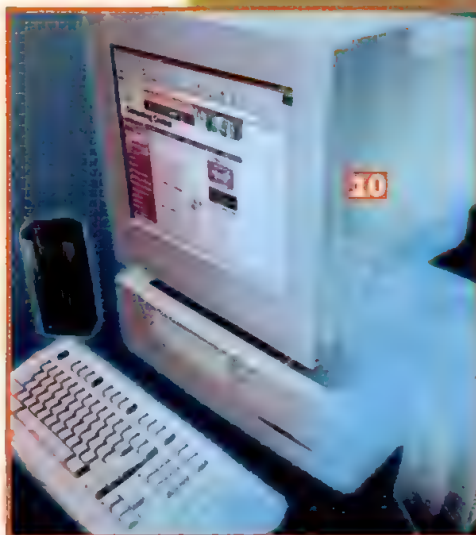
TYPICAL HOME PC BUYERS ARE IN AN INTERESTING predicament: They want to spend as little as possible, but some of the reasons for buying a home PC—digital imaging, DVDs, and especially games—often demand fairly high-powered hardware. By allocating resources carefully, you can put together a balanced system and still stay within budget.

Beyond the Box

Before we get into the nuts and bolts of the hardware, we want to draw your attention to issues that might not get mentioned in the computer superstore but will have plenty to do with your satisfaction.

PC makers have come a long way in improving the set-up process, especially for novice users. Look for easy-to-follow quick-start guides and color-coded connections. Since the first thing home users want to do is connect to the Internet, ask whether the set-up routine includes a wizard that can get you on the Web with just a few mouse clicks. Also, most name-brand PCs now include a trial membership (typically 30 days) with an Internet service provider (ISP) to get you started.

Pay close attention to the service and support options that are included. The new breed of ultra-low-price PCs need to make cuts somewhere, and technical support is often included only for a few weeks after purchase. We recommend buyers look for a three-year warranty, with toll-free technical support for the duration of the warranty. Another tip: Check the



hours that technical support is available. Are the phone lines staffed at night and on weekends, when you

are most likely to have questions? Finally, be open to bundles. If you are starting from scratch and need a printer and a scanner in addition to the basics, a package deal may be the way to go. Your printer and scanner won't be high-end, but if they are name-brand equipment, they are likely good enough.

The Hardware

You can spend as little as \$500 or as much as \$3,000 for a PC categorized as a "home" machine, and we have recommendations for such machines below. But for a general-purpose



You Need...

- Celeron/466 or AMD K6-II/400 processor
- 128MB RAM
- 10GB Ultra DMA/33 hard disk
- 16MB 2-D/3-D graphics accelerator **1**
- 17-inch monitor (0.28-mm mask pitch maximum; 1,024-by-768 resolution at 85-Hz refresh minimum) **2**
- 56.6K V.90 modem (network card for cable or DSL modem where high-speed service is available) **3**
- 6X DVD-ROM drive **4**
- 100MB or 250MB Iomega Zip Drive **5**
- 3-D sound card **6**
- three-piece speaker set **7**
- Microsoft Windows 98 **8**
- Internet keys **9**
- also: three-year warranty, one-year telephone support, lifetime Web support, 30-day ISP trial membership

\$1,500

LOW-COST INTERNET PC:

AMD, Celeron, or Cyrix processor; 32MB RAM, 2GB to 4GB hard disk, 4MB video RAM, 15- or 17-inch monitor, 56.6K V.90 modem, available PCI slot for high-speed modem upgrade, 24X CD-ROM drive, stereo speakers **10**

\$700

PC that delivers the right mix of performance, peripherals, and hand-holding, our perfect PC specs out to about \$1,500.

For that money, you should expect a Celeron/466 or AMD K6-2/400 processor. These chips deliver enough power for most home tasks yet leave enough in your budget for other extras. We also recommend 128MB of RAM, which will boost overall system performance. Also more memory means you can have more applications open concurrently.

If you aren't a big game player, any of the current graphics chips will deliver adequate 3-D (not to mention more-than-adequate 2-D). Do outfit the card with 16MB of video RAM. That will let you run at a higher resolution (1,024-by-768) and color depth on the 17-inch monitor we suggest, as well as run the latest 3-D games. The extra screen real estate also lets you see more of a Web page at a single glance.

Home users will find themselves using up stor-

age space fairly quickly. CD- and DVD-ROM titles encourage you to install some of their files on your hard disk for best performance. There are all sorts of things on the Web you won't be able to live without (and worry that you won't be able to find again), not to mention the MP3 music files that are fast becoming the standard way to distribute music on the Web. And if you don't already have one, we predict it will be just a couple of years before you have a scanner, a digital camera, or even a digital video camera. And you'll need enough space to store the images when you're working with them and until you find time to off-load them to removable storage.

So we recommend a hard disk of at least 10GB. You will want a mechanism for archiving files. The best choice for home users is a 100MB or 250MB Iomega Zip Drive. You can get one built in to your system from most PC makers (\$100 for the 100MB model, \$200 for the Zip 250), and the EIDE interface means that storing



Vectra

Engineered on a human level.

A meditation of movement and balance, the new HP Vectra PCs, running Windows NT® Workstation, are steady customers in the juggling act called Stability.

Substantiated by:

Consistent components so you never need to change your gold disk.

Early prototypes for fast qualification.

Instant Web-based alerts notifying you of any changes.

In other words, the Vectra Windows® 2000 Ready PCs® maintain a stable desktop environment so you keep pace with technology. Things to consider, when you're looking for a platform to balance your business on.

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pentium® III



Intel® Celeron™ processor 366 MHz up to Pentium® III processor 500 MHz / Microsoft® Windows NT Workstation 4.0 / 64 MB RAM / Up to 13.5 GB HD / Up to Matrox® MGA-G200 AGP graphics / HP TopTools management software / Starting at \$941**

*For more information, see www.hp.com/windows2000/desktop. **Price is estimated street price. Actual price may vary. Monitor not included. Intel, the Intel Inside Logo and Pentium are registered trademarks and Celeron is a trademark of Intel Corporation. ©1999 Hewlett-Packard Company. All rights reserved.



HP Brio PC
Microtower model

Intel® Celeron™
processor 366 MHz
64 MB RAM
4.3 GB UATA HD
128 KB internal cache
SiS Super AGPset
(4 MB SDRAM)
32x CD-ROM
Integrated PCI sound
Windows® 98
D7598T

\$750*

HP Brio PC
Microtower model

Intel Pentium® II
processor 400 MHz
64 MB RAM
8.4 GB UATA HD
512 KB internal cache
Matrox® MGA-G200 AGP
(8 MB SDRAM)
32x CD-ROM
Integrated PCI sound
Windows 98
D7624T

\$1,049*

Loaded

HP Vectra VE PC
Desktop model

Intel Celeron
processor 400 MHz
64 MB RAM
8.4 GB UATA HD
128 KB internal cache
SiS Super AGPset
(4 MB SDRAM)
32x CD-ROM
Integrated PCI sound
Windows 95
TopTools management
software
Smart Card ready
Master Key Lock ready
D8133T

\$985*

HP Vectra VE PC
Desktop model

Intel Pentium II
processor 400 MHz
64 MB RAM
8.4 GB UATA HD
512 KB internal cache
Matrox MGA-G200
AGP (8 MB SDRAM)
32x CD-ROM
Integrated PCI sound
Windows 95
TopTools management
software
Smart Card ready
Master Key Lock ready
D8153T

\$1,229*





HP Vectra VL PC Small desktop model	HP Vectra VL PC Desktop model	HP Vectra VL PC Minitower model
Intel Pentium III processor 450 MHz 64 MB RAM 8.4 GB UATA HD 512 KB internal cache Matrox MGA-G200 AGP 2x (8 MB SDRAM) 24x CD-ROM 10/100 Ethernet card Integrated PCI sound Windows NT® 4.0 TopTools management software Remote driver and BIOS update OpenView desktop administrator software Smart Card ready Master Key Lock standard C2 compliant BIOS D7857T	Intel Pentium III processor 450 MHz 64 MB RAM 6.4 GB UATA HD 512 KB internal cache Matrox MGA-G200 AGP 2x (8 MB SDRAM) 10/100 Ethernet card Integrated PCI sound Windows NT 4.0 TopTools management software Remote driver and BIOS update OpenView desktop administrator software Smart Card ready Master Key Lock standard C2 compliant BIOS D7952T	Intel Pentium III processor 550 MHz 128 MB RAM 13.5 GB UATA HD 7200 rpm 512 KB internal cache Matrox MGA-G200 AGP 2x (8 MB SDRAM) DVD 10/100 Ethernet card Integrated PCI sound Windows NT 4.0 TopTools management software Remote driver and BIOS update OpenView desktop administrator software Smart Card ready Master Key Lock standard C2 compliant BIOS D7976T
\$1,460*	\$1,442*	\$2,366*

Engineered on a human level.



HP 50 15" color monitor	HP 70 17" color monitor	HP 90 19" color monitor
13.7" viewable area 0.24 mm horizontal dot pitch 0.28 mm trio dot pitch D2826A	15.7" viewable area 0.24 mm horizontal dot pitch 0.28 mm trio dot pitch D2837A	18.0" viewable area 0.22 mm horizontal dot pitch 0.26 mm trio dot pitch D2842A
\$219*	\$325*	\$489*

To order, call 1-877-GO-BUY-HP,
visit www.hp.com or contact an HP reseller.





FOR THE GAMER:

You Need...

- Pentium III/450 processor
- 128MB RAM
- 10GB to 20GB Ultra DMA/66 hard disk
- 32MB 2-D/3-D graphics accelerator (ATI Rage 128 or nVidia TNT-2 chip set recommended) **1**
- 19-inch monitor (0.28-mm mask pitch maximum; 1,024-by-768 resolution at 85-Hz refresh) **2**
- cable or DSL modem (where high-speed service is available)
- 6X DVD-ROM drive **3**
- 3-D sound card **4**
- five-piece speaker system **5**
- force-feedback joystick **6**
- Microsoft Windows 98

\$2,800

items will be fairly quick. If you want to share the drive among machines, then get an external model with a USB interface (so that you can leave your parallel port free for your printer).

Alternatively, you may want to consider investing in a CD-RW drive (\$350). You can store up to 650MB of data on either reusable media (\$10 apiece) or write-once CD-R disks (\$2 each). The CD-R disks have the added advantage of being readable with any CD-ROM or audio CD player, so you can, for example,

share your digital image files with others or make your own music CDs.

Whether or not you opt for a CD-RW drive, we do recommend a DVD-ROM drive. Beyond the hundreds of movie titles available, there's a growing list of video-intensive multimedia games and edutainment titles available on DVD. We also recommend that you opt for a hardware DVD decoder. Our testing has shown that you need at least a Pentium III/400 chip to run DVD video smoothly without assistance; a Celeron or low-end Pentium II processor isn't powerful enough to deliver seamless video on its own.

If your area has cable modem service, we urge you to work it into your budget (\$150 for the modem; about \$50 for monthly service, which includes your ISP fees). The speed advantage over a 56.6K analog connection will vastly improve your Internet experience. Also look for a keyboard that has dedicated, programmable Internet keys to get you to your favorite sites with one touch.

Special-Purpose Machines

If your primary purpose is to get on the Web cheaply and if games, DVD, and digital imag-

ing aren't in your plans, you can pare down your machine and save money. A low-cost AMD or Celeron processor is fine, with a 4MB video subsystem, 2GB to 4GB hard disk, 24X CD-ROM drive, and 15-inch monitor. You can find such a system for \$700 or even less.

If you are a hard-core gamer, you'll need to go in the other direction; expect to spend between \$2,500 and \$3,000. Specify a Pentium III/450 processor, 20GB UltraDMA/66 hard disk, 19-inch monitor, and five-piece surround-sound speaker set mated to a 3-D sound card. Perhaps the most important link in the chain is the graphics accelerator. You'll want a 32MB card based on one of the fastest 3-D chips currently available: either the ATI Rage 128, Matrox G400, nVidia TNT-2, or forthcoming 3Dfx's Voodoo3.

Software

Every new home PC comes equipped with Windows 98, and most makers bundle all the basic productivity software you'll need to get started. Beyond that, we recommend you load your machine with an anti-virus package such as Norton AntiVirus, an easy-to-use image editor (we like Microsoft Picture It!), an entry-level publishing program for newsletters and the like (Broderbund's PrintShop or Microsoft Publisher 2000), software for family-fun projects like calendars and greeting cards (Canon Creative and any from the PrintPaks series), and a clip-art package. You'll also want to download Web utilities: RealAudio and RealJukebox for enjoying music over the Web and Macromedia's Flash and Shockwave to enjoy cutting-edge multimedia content.

Home Networking

If your home has two or more computers, you will inevitably want to move files, share a printer, stream video and audio, or share Internet access between them. Sharing involves networking, and you have plenty of affordable home network options. The challenges of successful home networking come in finding help when things don't work, setting up laptops already configured for wired offices, handling IP addressing, and maintaining security from Internet intruders.

Despite the slew of products on the market that use no wires at all or your home's existing phone or electrical wires, our idea of the perfect home network uses good old Ethernet. Retail stores carry 10-Mbps Ethernet adapters for all

How did we become the world's Digital Immune System?



By assuring productivity
in an IT environment
full of unknowns.

SYMANTEC.TM

The Symantec Digital Immune System™

Today's corporate IT environment is extended and vulnerable. With larger and increasingly complex networks, IT's job is more and more about managing the unknown. To accomplish it with limited resources, IT's value and credibility depend on its ability to maximize productivity with minimized support.

COST OF OWNERSHIP, USER UPTIME AND YOUR CREDIBILITY

As the enterprise grows and more users feel ownership of "their" systems, the threats to system costs, uptime and IT credibility take on many and varied forms. Mismatched software applications. DLLs on the same system. Highly fragmented or corrupted hard drives. And of course, the ever-present viruses.

Any of these problems can and will distract an organization from its core competencies, deflecting time and money into problem-solving and recovering from catastrophic system failures. And the larger the enterprise, the more "incidents" and the more far-reaching their potential impact.

But how can IT exert the kind of enforcement and control necessary to prevent, or eradicate, these ever-present threats before they impact productivity?

THE SYMANTEC DIGITAL IMMUNE SYSTEM

Symantec is now developing the Digital Immune System to provide a whole new level of protection and control through intelligent tools that keep systems up and running at peak performance. This system will enable you to pinpoint and resolve newly encountered problems proactively, and will automatically provide upgraded protection to deal with new threats.

The initial release of the Digital Immune System will feature our Norton AntiVirus® product line. As development continues, the Digital Immune System will go far beyond the realm of anti-virus to immunize your enterprise from a wide range of everyday incidents that threaten corporate productivity.

ON THE ATTACK

With the Digital Immune System, Symantec plans to offer many of its current best-of-breed solutions in an

integrated suite that can be purchased individually or as a package to meet your specific organization's needs.

The Digital Immune System Administrator

We're working on merging the systems and management technology from Intel® with the Norton System Center® to easily deploy, configure, monitor, update and centrally manage Symantec Digital Immune Ready software. We're targeting release of the Digital Immune System Administrator in late 1999.

The AntiVirus Solution

The first release of Symantec Digital Immune Ready software will be within our Norton AntiVirus family of products. Today, the Norton AntiVirus family of products have the fastest turnaround time on new viruses in the industry. Symantec's turnaround time to create a virus definition for the infamous "Melissa" virus was less than an hour. Our innovative services and technology include:

Norton AntiVirus Extension (NAVEX) technology allows you to update your scanning/repair engine as well as virus definitions across all platforms via our instant, single-click, LiveUpdate technology. NAVEX translates into lower TCO by never having to re-deploy anti-virus again!

Norton AntiVirus Corporate Edition connects with Symantec AntiVirus Research Center (SARC) via Symantec AntiVirus Research Automation (SARA) for automated analysis of new or unknown viruses detected by our heuristic "Bloodhound" technology. Quarantine safely isolates infected files on the system. And Scan and Deliver quickly and easily takes only the virus strain (not the entire infected file, for your privacy) and e-mails it to Symantec.

As a member of the Digital Immune System "global community," your network will immediately receive protection from any virus SARC discovers from any other customer anywhere in the world. Release of a Digital Immune Ready version of Norton AntiVirus is targeted for late 1999.

The Disk Optimization Solution

Norton SpeedDisk® improves server performance, providing increased throughput for groupware, databases, and other key applications. That means IT managers can

SYMANTEC DIGITAL IMMUNE SYSTEM™ CUSTOMER NEEDS MATRIX

Customer Need	Digital Immune System Solution
Systems & Policy Management	Digital Immune System Administrator
Virus Protection	Norton AntiVirus Corporate Edition
Server Performance	Norton SpeedDisk
Desktop Configurations	Norton Ghost, pcANYWHERE
Remote Systems Operation	pcANYWHERE
Management of Remote Users	Digital Immune System Administrator
System Recovery	Norton Ghost, pcANYWHERE



maintain their Service Level Agreements, increase end-user productivity, and – because installation, management, and administration is so easy – total cost of ownership is greatly reduced as well. Release of a Digital Immune Ready version of Norton SpeedDisk is targeted for the first half of 2000.

Remote Management Solution

pcANYWHERE™ lets administrators and support staff take control of end-user PC's or servers to provide quick, fully empowered support anywhere at any time. It's a powerful problem solver for help desks. Release of a Digital Immune Ready version of pcANYWHERE is targeted for the first half of 2000.

Disk Imaging and Widely Distributed Solutions

Through Norton Ghost®, IT can install, upgrade or restore clean, fully functioning disk images on hundreds of PCs, locally or remotely, in a matter of minutes. It's a powerful tool for maximizing user productivity while greatly reducing IT workload. Release of a Digital Immune Ready version of Norton Ghost is targeted for the first half of 2000.

TAKE CONTROL

The Symantec Digital Immune System will make it easy for administrators to install and manage these powerful tools at less cost and with fewer resources.

Through your secure connection to Symantec and by setting your scheduler, you will be able to control the timing and level of pro-activity to suit the specific needs of your organization. And you'll be able to set up domains, install and configure the tools, manage events, alerts and automated responses, as well as perform remote operations from the single central management console.

A WINNING COMBINATION

The Digital Immune System will be released as a Symantec solution created from the combined technologies and close collaboration of Symantec, IBM®, and Intel. By integrating the latest technologies from these industry leaders, Symantec is designing the Digital Immune System to dramatically increase IT's ability to make their enterprise computing environment a safe, manageable place to work. And dramatically reduce costs.

The Digital Immune System will utilize Symantec's best-of-breed software, IBM's advanced expert systems, and Intel's systems and policy management technology. All Digital Immune System solutions will be controlled by a single management console that works across multiple platforms, including DOS, Windows® 3.1, Windows 95 and 98, Windows NT® workstations, NetWare®, and Windows NT servers.

BE PROACTIVE

Until now, the systems and policy management functions needed to keep improving productivity in large organizations have been sorely lacking. Lacking an integrated strategy. Lacking adequate tools. And lacking control.

The Symantec Digital Immune System will be an important step forward for IT. And against the threats you face every day. For the first time, with solutions designated "Digital Immune Ready," IT can truly take a proactive leadership role in protection, detection and solutions for desktop and server productivity.

SYMANTEC.

Call 1-800-745-6054, ext. 9UW1
or visit www.digital-immune-system.com
for information and a FREE Digital Immune System CD ROM

We've described our current plans for our proposed Digital Immune System; however, our plans and targeted release dates may change so we encourage you to contact us for the latest information.

Maximize user productivity. Minimize support from IT.



Norton
2000



Norton Ghost



pcANYWHERE



Norton
AntiVirus



Norton AntiVirus
Norton 2000
pcANYWHERE
Norton Ghost
WinFax PRO



Norton
AntiVirus



Norton
AntiVirus



Norton AntiVirus
pcANYWHERE



Norton
AntiVirus

Symantec Corporation is the acknowledged worldwide leader in utility and communications software for business and personal computing. 100% of the Fortune 1000 trust Symantec products with their company information every day.

As the IT environment evolves, with more connected systems, Symantec is there with the critical solutions that enable IT to keep that environment productive, cost-effective, and safe. Not just with the industry standards for AntiVirus, utility, and security solutions, but with important Java development tools, and mobile worker software as well.

With a clear commitment to create leading edge products and solutions that maximize user productivity and minimize support required from IT, Symantec is poised to further enhance the productivity gains derived from networked PCs now and in the future.

SYMANTEC SOLUTIONS FOR THE CORPORATE ENVIRONMENT

HELPDESK AND REMOTE ACCESS

- pcANYWHERE
- Norton Helpdesk Assistant
- Symantec Mobile Essentials
- Winfax Pro

NETWORK SECURITY AND ASSISTANCE

- Symantec Digital Immune System
- Norton AntiVirus Solution
- Norton 2000 Corporate Edition
- Norton 2000
- Norton Ghost

SYMANTEC.

Call us at 1-800-745-6054, ext. 9UW1

or visit www.symantec.com to download free trial versions of Symantec solutions

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09-71-00326

How to Network Your Home

Home networking is about sharing things like printers, video, sound, and Internet access. Many home networking alternatives, such as telephone line and AC power line sharing, are on the market, but standardized Ethernet is the easiest, most economical, and most widely supported choice. If you absolutely can't pull Ethernet cable to some part of the house, then a wireless LAN flexibly extends the wired network.



Fast Connections Compared

	WHO PROVIDES LINE AND SERVICE	INSTALLATION COSTS / MONTHLY COSTS	DOWNLOAD SPEED	LIMITATIONS
56K analog	Phone line; local phone company; service: independent ISP	Modem, \$50-\$250 / \$19 plus cost of phone line	Up to 56 Kbps, depending on local line condition	Time required to dial and link up
ISDN	Phone line; local phone company; service: independent ISP	Typically \$100-\$300 / Phone line, \$19-\$50 (plus per-minute charges); ISP, \$19-\$39	64 or 128 Kbps	Must be within 19,000 feet of the central office
ADSL	Local phone company or competitive exchange carriers	\$100-\$500; modem, up to \$610 / \$39-\$189; may not include Internet connection	124 Kbps-8 Mbps	Speed varies with distance from the central office; maximum 20,000 feet
Cable modem	Local cable operator, often acting as agent for a national cable provider	Free or up to \$175; modem, up to \$349 / \$30-\$50 including Internet connection	384 Kbps-4 Mbps	Must have cable TV available; shared connection
DirecPC satellite	DirecPC (Hughes Electronics, a division of GM)	\$300-\$800 / \$29.99-\$129.99 plus analog phone line and modem	400 Kbps	Requires outside antenna

FOR THE ROAD:

You Need...

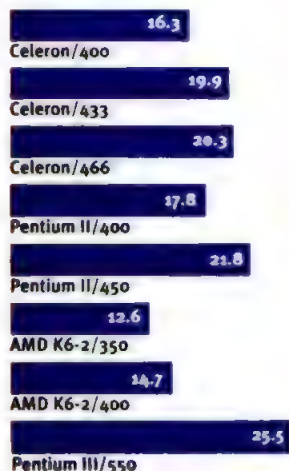
- Celeron/386 or AMD Mobile K8-2 processor
- 64MB RAM
- 4GB to 10GB hard disk
- 5MB 2-D/3-D graphics subsystem
- 13-inch TFT display **1**
- Type III PC Card slot with a 56.8K V.90 PC Card modem **2**
- built-in 24X CD-ROM drive or 4X DVD-ROM drive **3**
- built-in floppy disk drive **4**
- built-in stereo speakers **5**
- also: dedicated Internet keys, CD controls, Microsoft Windows 98, three-year warranty, one-year telephone support, lifetime Web support, 30-day ISP trial membership

8 pounds, \$2,000

Comparing System Performance

Here are the average scores of typical home configurations, based on these processors.

ZD BUSINESS WINSTONE 99
(64MB RAM)



BETTER>



dardized, and widely available. Many vendors and VARs provide help with Ethernet questions, and your laptop equipped for Ethernet at work can easily interact with your Ethernet LAN at home.

The drawback to standard Ethernet is that you have to run cables between the devices on the network. The Ethernet cable, called *unshielded twisted-pair* (or UTP), is only a little more than a quarter of an inch thick and can easily run behind desks and even along or under carpeting. You can fish it through walls, or hire an electrician to pull it for you (typically about \$100 to \$150 per room).

Sharing an Internet access is the biggest goal and challenge for home networkers. You'll want a function called *network address translation* (NAT) for handling IP addresses inside and outside

the LAN and for some protection from intrusion. These functions can come from a dedicated piece of hardware (Ramp Networks has been a leader here) or from software, such as WinProxy Lite, from Osis Software, or WinGate, from Deerfield Communications, running in a PC.

the LAN and for some protection from intrusion. These functions can come from a dedicated piece of hardware (Ramp Networks has been a leader here) or from software, such as WinProxy Lite, from Osis Software, or WinGate, from Deerfield Communications, running in a PC.

What You Get from the Top Companies

Acer America Corp. A member of the Acer Group and the third-largest PC manufacturer in the world according to IDC, Acer has recently opened its own online store at www.shopacer.com. The easy-to-navigate site offers PCs based on three criteria: lowest price, best value, and high performance. Surprisingly, there is no way to tailor your selection of PC, other than to add a printer or scanner. If you are a registered customer, your address information is entered from memory; you just pick the method of shipment and enter your credit card information.

The primary case for the home line, the Acer

Aspire series, is a stylish microtower, although not as colorful as the 1996 Aspires that came in charcoal and emerald. (Now, however, it's easier to match colors with non-Acer monitors.) It offers decent room for expansion: One drive bay of each size is open, and two USB ports are free (one on the back of the system and one on the keyboard). Two PCI slots are free as well. Additional features on the keyboard include a volume knob, a mute button, a sleep button, and a quick-launch Internet button. Another nice touch is the model-specific setup videos that are resident on the hard disk.

Acer's warranty covers one year of parts

Flash helps millions of hearts race daily.

When the world met the sleek
new TT at AudiUSA.com,
Flash made the introductions.

Engaging. Responsive.

Performance-driven.

And, of course, so is the TT.

If you want your website
to quicken millions of pulses,
take Flash for a spin.

www.macromedia.com



add life to the web


macromedia®



User Tips

- ✓ **Read the fine print.** That deal that looks too good to be true may be: The low ball system prices often leave out the monitor (add \$250) and sometimes even basic software (another \$200).
- ✓ **Let them guide you.** If you are a technical novice, opt for a brand that includes a quick-start guide and color-coded cables and connections.
- ✓ **Get on the Net.** Be sure the setup routine includes a wizard that walks you through the steps to get on the Internet—and be sure a free trial membership (typically 30 days) is offered for a major ISP.
- ✓ **How's the timing?** Check that the company offers technical support on nights and weekends—when most home users will most likely call.
- ✓ **Call your cable company.** Check to see whether cable modem or DSL service is available in your area. The high-speed connection makes surfing the Internet much more enjoyable.

and labor—meager in comparison with the other competitors. This could account for Acer's overall grade of E on our Service and Reliability Survey. All Aspire systems come with Acer's TimeMachine Technology—a recovery utility: If you have a system problem caused by new software, new hardware, or a damaged file, you simply roll back your configuration to an earlier one that worked. Support includes e-mail queries, toll-free technical support, and an online tips and tricks section. (San Jose, CA; 800-733-2237; www.shopacer.com.)

Apple Computer Corp. Once-moribund Apple is today the purveyor of some of the hottest, best-designed computers on the market, the iMac and the Power Macintosh G3. Taking a cue from their traditional markets—graphic design and education—the new Apples are bright, beautiful, futuristic yet retro, and easy to use.

Apple's Web site offers information on the two systems listed above as well as software and other options. When you're purchasing an iMac online, the only options are to increase memory and to add peripherals like printers and Iomega Zip Drives. But the Web site lets you file for an Apple loan or lease agreement and even provides a calculator for figuring out the cost of your monthly payments. (The ordering process for the Macintosh G3 is significantly more customizable, with many more drop-down menus.)

The iMac, based on the 333-MHz PowerPC G3 CPU, comes in five glorious colors: strawberry, lime, tangerine, grape, and blueberry. A 6GB hard disk, two USB ports, an ATI Rage Pro Turbo card, and a built-in 56K modem come ready to use; all you need to do is plug in the power cord and modem and attach the keyboard and mouse. Online support includes plenty of information on start-up issues, peripherals problems, and software updates. Apple receives a B grade on our Service and Reliability Survey. (Cupertino, CA; 800-795-1000; www.apple.com.)

CompUSA. One of the biggest computer mega-stores and long a venue for other brands, CompUSA offers its own brand line through

the retail channel as well as online. Pointing your browser to www.compusa.com leads you to two standalone sites (and, in fact, separate divisions of the company), *CompUSANet.com* and *CompUSAstores.com*.

The CompUSANet Web site offers brand-name systems for sale, including the CompUSA PC brand for the time being. It is a robust site, with plenty of drop-down menus for configuring your system and a way to check the status of your order. Besides a standard one-year parts-and-labor warranty, the vendor offers a ten-day satisfaction guarantee (though you will be charged a restocking fee). The site does not offer driver updates or any other form of technical support aside from the technical-support phone numbers.

The CompUSAstores Web site is bland for now, including only information about the stores, store specials, promotional events, technical services and training, and company history. You can not configure or order PCs. At press time, CompUSA was in the middle of redesigning its case options, but no specific information was available. CompUSA receives an overall grade of C on our Service and Reliability Survey. (Dallas; 888-266-6772, 508-480-8500; www.compusa.com.)

Once-moribund
Apple now
sells some of the
hottest-selling, best-
designed PCs around.



Compaq Computer Corp. A relative newcomer to the direct world, Compaq still sells systems through retailers and service centers. The Presario, Compaq's home/home-office line, comes in several models—the 5000, 5100, 5200, and 5600 series—which are powered by Intel or AMD CPUs, depending on the system. Prices start at \$599 (for the

5070), which includes two USB ports for easy connectivity and a keyboard with one-touch access to the Internet.

One of the more interesting features of Compaq's easy-to-use and informative Web site is the Selection Assistant, a guide that matches you with a Compaq computer by covering areas such as About You, Usage Environment, User Needs, and Price Range. Online configuration is fairly customizable, with plenty of drop-down menus. Additionally, the site offers downloadable drivers, patches, and FAQs as well as installation, technical, and software guides.

Create **tastier** websites with **Dreamweaver** and **Fireworks**.



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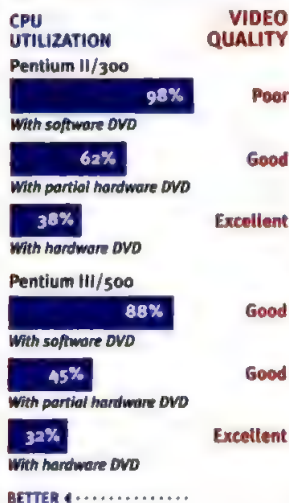
The future in design is here: Apple's beautiful iMac and Sony's VAIO slimtop.



and registering for FileWatch gets you an e-mail alert. Dell's Knowledge Base is constantly updated by technicians and customers, and this information is fed into Ask Dudley!, a natural-language-based query system. Last, Dell Talk Forum is a public discussion forum for customers to talk to each other—and it's not censored for content, only for accuracy. (Round Rock, TX; 800-388-8542; www.dell.com.)

Software vs. Hardware DVD Decoding

Lesser processors can't handle the demands of DVD without help.



Another nice touch: There's an 800 number at the bottom of each page on the site.

The typical warranty of one year parts-and-labor service with 90 days of on-site service (very low for the industry, and some Compaq models offer none at all) can be upgraded to three years parts, three years on-site for an additional fee. For home PCs, Compaq receives a grade of E on our Service and Reliability Survey. (Houston; 800-345-1518; www.compaq.com.)

Dell Computer Corp. The Big Daddy of direct vendors, Dell Computer Corp. sells systems via phone and the Internet, with an almost exact split between the two these days. Not surprisingly, the company's Web site is comprehensive and easy to navigate. Also not surprising, Dell earns an A for its home PCs on our Service and Reliability Survey.

Dell's new home line, the Dimension L, is housed in a compact and sturdy microtower. Its crowning achievement is the one-touch-open case. Traditional Dell design coups are still present (swing-out power supply, slide-out drives, and the service tag number), and another one debuts, the Dell Diagnostic LED, which provides a quick diagnosis of video failures.

Since going to the sub-\$1,000 price point, Dell has maintained its three-year parts-and-labor warranty policy, which still includes one year of on-site service and lifetime toll-free technical support. Its online support is top-notch: Plugging in your service tag number gets you driver updates and news specific to your system,

another direct powerhouse, has recently redesigned its Web page. Although the site is now fairly straightforward and easy to use, it could still benefit from some fine tuning. Specifically, since Gateway is a build-to-order shop, the Customize option could be more obvious.

That said, Gateway's online support is excellent. Technical support includes hot topics like virus warnings and year 2000 compliance tests, as well as driver downloads for hardware and software, tech tips, and FAQs. Most impressive are the technical documents and jumper settings for an incredible array of hardware.

There are two lines available for the home, Essential and Select, available online, over the phone, or from a local Gateway Country Store. The Essential line, which starts at \$699, is based on the Intel Celeron CPU, with 32MB of RAM, integrated graphics, and a one-year parts-and-labor warranty. The Select line starts at \$999 and is based on AMD CPUs, with 64MB of RAM, integrated graphics, and a one-year parts-and-labor warranty. (A higher-end Performance line appeals to power users.) Gateway receives a C for home PCs on our Service and Reliability Survey. (North Sioux City, SD; 800-315-2536; www.gateway.com.)

Hewlett-Packard Co. HP offers PCs, printers, digital-imaging products, monitors, software, and various accessories worldwide; with so much to choose from, the Help Me Choose sections on HP's Web site are particularly useful. HP receives a grade of C on our Service and

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Home User Service and Support Policies

✓ Yes ✗ No	Vendor grade*	Money-back guarantee	Technical support hours (eastern time)	Free telephone support	Technical support Web site	Typical response time for support question posted to Web site	Standard warranty on parts/labor	On-site service handled by	On-site service for first year	Average turnaround time for PC repair	Shipping paid	Orders accepted via the Web	Order tracking via the Web	Web support according to model	E-mail notification of driver updates	Duration of ISP trial membership
Acer	E	Varies by dealer	7:00a-midnight	Varies by model	AcerSupport.com	Info not available	1 year/1 year	Info not available	Varies by model	1-2 days	Return only	✓	✓	✓	✗	50 hours
Apple	B	None	9:00-9:00, 7 days	90 days	www.apple.com/support	Info not available	1 year/1 year	Authorized service provider	Included	2-3 days	Carry-in service only	✓	✓	✓	✓	30 days
Compaq	E	Varies by dealer	24 hours, 7 days	1 year	www.compaq.com/athome/support/index.html	1-2 days	1 year/1 year	Compaq reseller	\$39	2 days	Both ways	✓	✓	✓	✓	30 days
CompUSA	—	14 days	24 hours, 7 days	Lifetime	www.compuser.com	1 day	1 year/1 year	CompUSA	\$99	4-5 days	Carry-in service only	✓	✓	✓	✗	30 days
Dell	A	30 days	24 hours, 7 days	Lifetime	www.dell.com	1 day	3 years/3 years	Banc-Tech Service Corp.	Included	1 day	Both ways	✓	✓	✓	✓	30 days
Gateway	C	30 days	24 hours, 7 days	Varies by model	www.gateway.com/support	1-2 days	1 or 3 years/1 or 3 years	TSS	Included	3-5 days	Both ways	✓	✓	✓	✗	Varies by model
Hewlett-Packard	C	Varies by dealer	24 hours, 7 days	1 year	www.hp.com	Info not available	1 year/1 year	N/A	N/A	5-7 days	Both ways	✓	✓	✓	✓	N/A
IBM	A	Varies by dealer	24 hours, 7 days	1 year	www.pc.ibm.com/support	1 day	1 year/1 year	N/A	N/A	Info not available	Info not available	✓	✗	✓	✓	Varies by dealer
Micron	B	30 days	24 hours, 7 days	Lifetime	support.micronpc.com	Same day	3-5 years/3 years	Unisys	Included	1-2 days	Return only	✓	✓	✗	✗	Varies by dealer
NEC Ready	C	Varies by dealer	7:00a-3:00a	1 year	www.nec-computers.com	3 hours	1 year/1 year	Wang	\$79	3-5 days	Return only	✗	✗	✓	✗	Varies by dealer
Packard Bell NEC	E	Varies by dealer	7:00a-3:00a	1 year	www.packardbell.com	3 hours	1 year/1 year	Wang	\$79	3-5 days	Return only	✗	✗	✓	✗	Varies by dealer
Sony	C	Varies by dealer	24 hours, 7 days	1 year	www.itsa.sel.sony.com/support/pc	Info not available	1 year/1 year	Multiple vendors	N/A	7-10 days	Both ways	✓	✗	✗	✓	Info not available

* Based on PC Magazine's 1999 Service and Reliability Survey. A dash indicates that the vendor is not represented in our published survey results for 1999.
N/A—Not applicable: The vendor does not offer this service.

Reliability Survey for home PCs.

HP's Pavilion home systems come in three series. The Pavilion 4000 Series has a small form factor at a low price, using a Celeron or AMD K6-2 CPU. The Pavilion 6000 series, also in a microtower case, can include a Celeron or a Pentium II. The Pavilion 8000 series is more high-end, typically with a Pentium III CPU under the hood, integrated networking, a DVD drive, and HP's CD-Writer Plus. Certain systems are available only at resellers and retail stores, while others are available only via the Web.

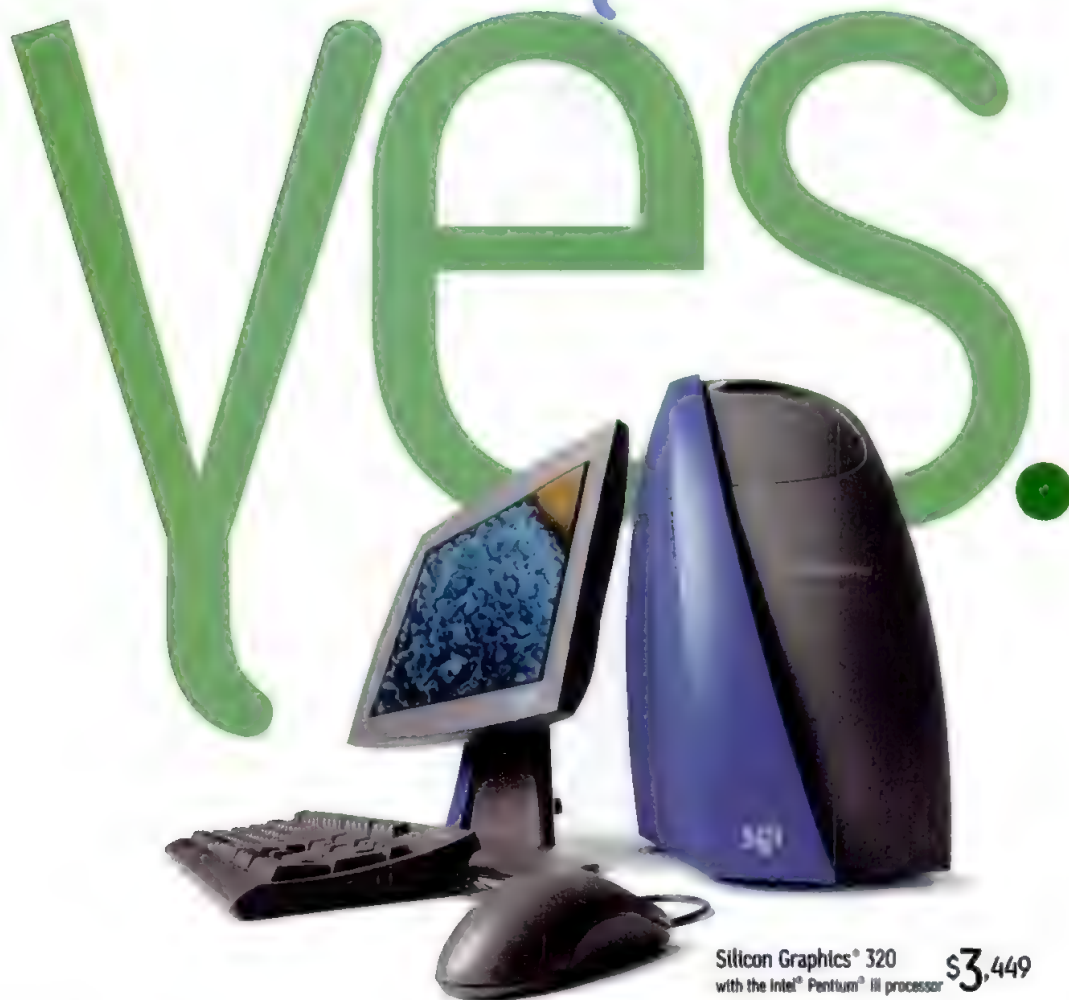
Support includes HP Help, a preloaded application with animated tutorials, FAQs, and a glossary of PC terms. It is updatable via the Web. Online support includes HP Customer Care, which provides drivers, maintenance tips,

troubleshooting documents, and a community forum, all based on your model of Pavilion. One complaint with HP's Web sites: Each section (Shopping Village, Customer Care) opens a new browser window. (Palo Alto, CA; 800-322-4772; www.hp.com.)

IBM Corp. IBM's entry- to mid-level offering, the Aptiva E microtower, is standard beige across the line, unlike the racy black design of the S Series. Yet it is not without its merits: A standard configuration offers one free internal hard disk bay, two free expansion slots, and two free USB ports. All Aptiva E systems include the IBM RapidAccess keyboard which offers four programmable buttons (for the Internet, games, applications, and so on), IBM ViaVoice software for voice-dictation functions, and a

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from **no way** to
maybe to

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*Bandwidth based on graphics to main memory. All prices subject to change.
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PC EDITORS' HOT LINKS

> Family PC Magazine

www.familypc.com

This site, the Web component of our sister publication Family PC, is our favorite source for family-friendly hardware and software reviews and information (next to www.pcmag.com, of course).

> Ask Jeeves for Kids

www.ajkids.com

This is the best search site that we've found geared specifically for kids. The interface is intuitive, and the search box lets school-age kids enter questions in full sentences (it'll even check their spelling). Best of all, you don't have to worry about a search turning up an errant XXX site.

> Music on the Web

www.mp3.com

www.musicmatch.com

These sites are the leading providers of MP3-encoded music. Log on to download an MP3 player and compressed music files (some free, some at a nominal cost). Turn your hard disk into your personal jukebox.

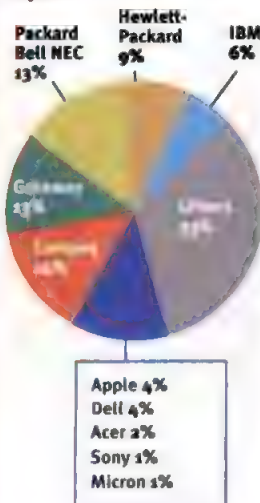
> iVillage

www.ivillage.com

One of the first and largest sites dedicated specifically to women and the family, iVillage features news and tips on health, relationships, career, food, finances, and more.

Top 10 Home Vendors

No single vendor has a commanding market-share advantage among home PC buyers.



Figures are 1998 U.S. unit shipments.

Source: International Data Corp., May 1999 (www.idc.com).

headset microphone. Some of the models also include the IBM ScrollPoint mouse.

Purchasing options include IBM-certified resellers, the Web, phone, and fax. Ordering online is easy, but the systems aren't very customizable. All Aptivas include a one-year parts-and-labor warranty, which is short compared with other vendors' offerings but is boosted by IBM's Owner Privileges, a program that includes toll-free preferred-caller handling for the period of the warranty, productivity tips via e-mail, a FAQ database of help questions, and Update Connector—information on updating your PC and new drivers. For the seventh year, IBM receives an A overall on our Service and Reliability Survey and also receives an A for home PCs. (Armonk, NY; 800-426-7255; www.ibm.com.)

Micron Electronics. Micron PC is a subsidiary of Micron Electronics, the third-largest computer seller via the direct channel. The company's home lines, the Millennia and the Millennia Max, come in a choice of desktop, mini-tower, and full-tower cases. The full tower is a gigantic case that opens easily and offers room for expansion. There's even housing for adding more cooling fans. One thing: There are no USB ports on the front of the case. On the plus side, each system includes an Internet wizard (providing 30 days of free access) and a year's subscription to Micron University (for computer-related classes on the Web).

Micron's Web site is as comprehensive as it is easy to use. The information on the Millennia is exhaustive, including explanations regarding the technology behind every piece of hardware. Each system is highly customizable, and a slew of options and peripherals are also available. Micron receives an overall grade of B on our Service and Reliability Survey. Its online support includes FAQs, Desktop Knowledge Base, Desktop File Library, and support contacts. There is also a section on Y2K information and a way to track your order status. (Nampa, ID; 888-634-8799; www.micronpc.com.)

Packard Bell/NEC. Packard Bell and NEC merged in 1996 to form Packard Bell/NEC, with Packard Bell handling the consumer sector and NEC offering commercial systems. The consumer section includes all Packard Bell-branded systems as well as the NEC Ready desktops and notebooks.

The Ready desktop is housed in a big case that opens with thumbscrews. That's the easy part; the side panel, however, is hard to remove. Although the case offers three free drive bays, the micro ATX motherboard does not reach all of the expansion cut outs, it offers only open slots.

The online support section includes FAQs, downloads, a knowledge base, a message board, and a how-to section. You can also customize the support center by registering your system's serial number online.

The Packard Bell brand receives a low grade of E for home PCs on our Service and Reliability Survey; NEC gets a C for home PCs. (Sacramento, CA; Packard Bell sales, 800-733-5858; www.packardbell.com. NEC Computer Systems Division, 888-863-2669; www.neccomputers.com.)

Sony Electronics. Sony has its tentacles in all aspects of today's pop culture: music, video games, movies, TV, and computers. Just try getting to the computer section of Sony's vast Web site without getting distracted; after all, there's Jeopardy Online beckoning you. Sony computers are available online at Sony VAIO Direct, as well as through retail channels such as Circuit City, mail order such as PC Zone, and national distributors.

Online purchasing is limited. The last time we looked, only one desktop was available for purchase online, but there were at least ten monitors available. Online support, however, is more robust and includes a knowledge database, FAQs, year-2000 compliance information, error messages, and news.

The Sony VAIO Slimtop LCD Computer is so compact you might just lose it on your desk. A 14.1-inch LCD comes on a dual-hinged pedestal for flexible viewing; the wrist rest folds up to protect the keyboard, which includes six hot buttons for the Internet and favorite applications; and the Slimtop case is as thin as a pizza box. The Memory Stick digital media technology accepts 4MB and 8MB memory sticks, each the size of a stick of gum. The Slimtop currently offers only a CD-ROM drive rather than a DVD-ROM drive. There's a more traditionally styled Sony VAIO Digital Studio mini-tower PC offering IEEE 1394 (also called FireWire) connections for capturing and then editing movies from digital video cameras. Sony gets a C for home PCs on our Service and Reliability Survey. (San Jose, CA; 888-476-6972; www.sony.com/pc.) **PC**

Yes starts here.

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Blazing NT graphics performance. At affordable prices.

Silicon Graphics® 320

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- Supports up to two Intel® Pentium® III processors
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\$6,499

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- 128MB ECC SDRAM (expandable to 2GB)
- 9.1GB Ultra2 SCSI hard drive
- Integrated 10/100 Fast Ethernet
- IEEE-1394, parallel, serial, USB, video and audio ports
- Microsoft® Windows NT® Workstation 4.0

Silicon Graphics 540

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- 9.1GB Ultra2 SCSI hard drive
- 17" [16" viewable] monitor with Trinitron technology
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Silicon Graphics 540

Dual Intel® Pentium® III Xeon™ processors 550MHz

\$9,599

- 512MB ECC SDRAM
- 9.1GB Ultra2 SCSI hard drive—10,000RPM
- 17" [16" viewable] monitor with Trinitron technology
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To get information, find a local reseller or to order,
call 1 888 SGI-4289 or visit us at www.sgi.com/go/visual
[Reference # 4289-07]

*Requires additional software under Windows NT Workstation 4.0. Prices quoted are for U.S. only. All prices subject to change.
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THE Technical Pro USER

FROM 2-D CAD AND IMAGE EDITING TO 3-D MODELING AND ANIMATION, MANY TASKS CALL FOR AN ENTRY-LEVEL WORKSTATION.

By Code Metz

You Are...

- an engineer using CAD/CAE software to develop products.
- a designer working with 3-D representations of complex objects.
- an architect who needs to draft and render designs and create 3-D models for virtual walkthroughs.
- doing advanced 3-D animation for the Web or videos.
- an audio-visual production specialist.
- a scientist building molecular models or simulations of the physical world.

WITH THE ADVENT OF THE INTEL PENTIUM III Xeon chip, many of the market's leading graphics workstations—like many of the leading servers—now run Microsoft Windows NT from a less inexpensive platform, instead of requiring a proprietary RISC-based architecture as in years past. To be sure, there is a large market for Mac and Unix workstations, but today's technical pro users—including engineers running *computer-aided design* (CAD) software, programmers integrating 3-D animation into Web sites and video projects, architects generating 3-D models of buildings-to-be, financial analysts who demand real-time data analysis, and video editors piecing together multiple streams of sound and image—can have the best of both worlds: RISC-level performance and a sub-\$15,000 price tag. Further, they can run all their standard office applications on the same platform, which is a significant cost savings compared with the era when both an x86 box and a Unix box were required.

Thus, our perfect technical pro system offers a 550-MHz Pentium III Xeon—if not two 550-MHz Pentium III Xeons—in addition to adept OpenGL graphics technology and a never-less-than-dazzling monitor. Of course, since Xeon is readily available from most leading workstation vendors, what separates the perfect workstation from the also-rans is its chassis design, which allows for quick and easy upgrades and repairs.

If you're interested in relatively modest 2-D modeling, you'll need only the one Xeon chip, but the ideal 3-D workstation includes dual CPUs for use with certain multithreaded applications. Next, we insist on 256MB of SDRAM, for manipulating large, memory-hungry image files. Opting for the common

x86 platform not only brings down the initial cost of your workstation, but brings down the cost of upgrades as well.

What then makes this machine a workstation, rather than a desktop or server, is its graphics card, a 2-D/3-D OpenGL accelerator: HP's Visualize fx6 or Intergraph's Intense3D Wildcat 4000, for example. Equipped with at least 16MB of frame-buffer memory and 64MB of texture memory, such cards support 16.7 million colors at a 1,280-by-1,024 resolution or better and an 85-Hz refresh rate. Naturally, they also support the latest OpenGL API—and several lesser APIs as well.

To get the most out of this class of card, you must have an equally adept monitor. We recommend a 21-inch model with a 0.27-mm mask pitch maximum. It should support a 1,600-by-1,200 resolution at a minimum 75-Hz refresh rate and offer a full range of digital controls for customizing or correcting the image. Most important, the picture must suit your particular tastes. Always test-drive your monitor before purchasing.

If you have a few extra dollars to spend, we





You Need...

- Pentium III Xeon/550 processor (dual Xeons for a 3-D workstation)
 - 256MB RAM
 - 80MB 2-D/3-D OpenGL graphics accelerator **1**
 - 18GB to 24GB SCSI-2 hard disk (optional: dual 10GB disks in a RAID configuration) **2**
 - 21-inch monitor (0.27-mm mask pitch maximum; 1,600-by-1,200 resolution at 75-Hz refresh minimum) **3**
 - 10/100 Ethernet
 - DVD-RAM drive **4**
 - slide-out drives **5**
 - user-replaceable fans and power supply **6**
 - Microsoft Windows NT 4.0
- \$9,000**

recommend augmenting this primary monitor with a secondary display. With two monitors, you can have an unobstructed view of your drawing or 3-D model on one screen and your application toolboxes open on the other.

When generating and subsequently storing large 3-D models or video, you'll also need a fast and spacious hard disk unless you save most work to the network. We recommend a 10,000-rpm Ultra-2 SCSI disk with at least 18GB of storage space. If you're worried about disk failure, you can alternatively opt for a RAID controller and two redundant 10GB disks in a RAID configuration. Whichever you choose, make sure there's space left over in the system chassis for additional hard disks, in case you require more storage space in the future.

Such a collection of core hardware will certainly satisfy most technical pro users, but audio and video editors will need a bit more. You could buy a far more expensive RISC workstation properly equipped for video editing or add several thousand dollars of hardware to the machine we've described above, but the best

option for video editors may be the new SGI 540 Visual Workstation.

When used with certain specially coded software packages, this machine lets you input multiple streams of video, edit them with various effects, then output them in real time. Though not quite as adept with CAD software as many other Xeon workstations on the market, the SGI 540 is not only ideal for video editing but well built and relatively inexpensive.

Finally, we augment our core of hardware with a few other essentials, including a 10/100 Ethernet card for connecting to your office LAN, a floppy disk drive, a CD-ROM drive, and dual USB ports. The system is then encased in a manageable yet durable chassis. There are plenty of fans to keep the system properly cooled and plenty of available bus slots for future upgrades. You can also easily replace all of the fans, power supplies, and disk drives in case of failure. In fact, the drives can be easily removed without the aid of screwdrivers or any other tools. Computing power does not preclude ease of use. **PC**

User Tips

- ✓ **2-D or 3-D.** The machine you'll specify varies widely according to whether you will be doing 2-D CAD work or 3-D modeling.
- ✓ **Consider RAID.** Adding a second hard disk and a RAID controller (\$500) will give you the redundancy you'll need should your primary disk fail.
- ✓ **Dueling displays.** Consider a dual-monitor solution, so you can have toolbars open on one screen and an unobstructed view of your drawing on the other.

THE Corporate IS MANAGER

WHETHER IT'S FOR A BRANCH OFFICE OR A
LARGE ENTERPRISE, FINDING A SERVER TO
MEET YOUR NEEDS IS ESSENTIAL.

By Jamie M. Bsales

You Are...

WORKGROUP:

- the corporate IS manager for a small to medium-size company or workgroup.

- looking to buy a system that can operate as a file server, e-mail server, or Internet/intranet server for up to 50 people.

ENTERPRISE:

- the IS manager for a large corporation.

- putting together a system that can handle numerous applications and act as a data center for your company.

IN A BUSINESS ENVIRONMENT, A PC CAN hardly be considered perfect unless it's accompanied by perfection in its server. Today, whether your perfect PCs sit on a workgroup LAN or a sprawling enterprise network, your perfect server should be built around processors from Intel's new Pentium III family. Though relatively inexpensive, these chips are gradually approaching the performance levels of many RISC chips, those high-priced exemplars of server markets past. With these chips, you'll get great performance running NetWare, Windows NT 4.0, or the increasingly popular Linux. Windows NT is preferable if you'll be running lots of server-based applications, while—

if you have the know-how—Linux is ideal for executing certain Web functions such as Domain Name Service (DNS) or the Dynamic Host Configuration Protocol (DHCP).

Whichever processor or OS you use, your server must be reliable and easily serviced, offering tractable casing, hot-swappable power supplies, drives that are easily removed, adequate cooling, and ample room for expansion. It should also include an application, such as IBM's NetFinity Manager or HP's TopTools, that lets you easily manage and monitor such complex hardware via software.



Then of course, a server must fit your business's particular needs. Our perfect workgroup server for up to 100 users (depending on the application), for which you can expect to pay approximately \$7,000 to \$10,000, is a standalone system built around two so-called desktop Pentium III chips. Our perfect enterprise server, meant for data center applications such as ERP and OLTP, is a hulking, rack-mountable machine with four Pentium III Xeon chips, each equipped with a full 2MB of secondary cache. This configuration costs between \$50,000 and \$75,000. Small businesses and branch offices without an IS staff will want to consider a server appliance—an affordable (less than \$3,000), all-in-one, plug-and-play device ideal for Internet functions, e-mail and file services.



FOR THE **WORKGROUP:**

You Need...

- dual Pentium III/550 processors **1**
- 256MB SDRAM ECC memory, expandable to 1GB **2**
- up to five hot-pluggable Wide Ultra2 SCSI hard disks with SMART disk technology **3**
- three PCI slots, one ISA/PCI slot **4**
- 10/100 Ethernet **5**
- dual-channel Wide Ultra2 SCSI-3 controller **6**
- tool-free access to case
- hot-swappable power supply **7**
- management and monitoring software
- thin server (for small workgroups without IS staffs) **8**

\$10,000

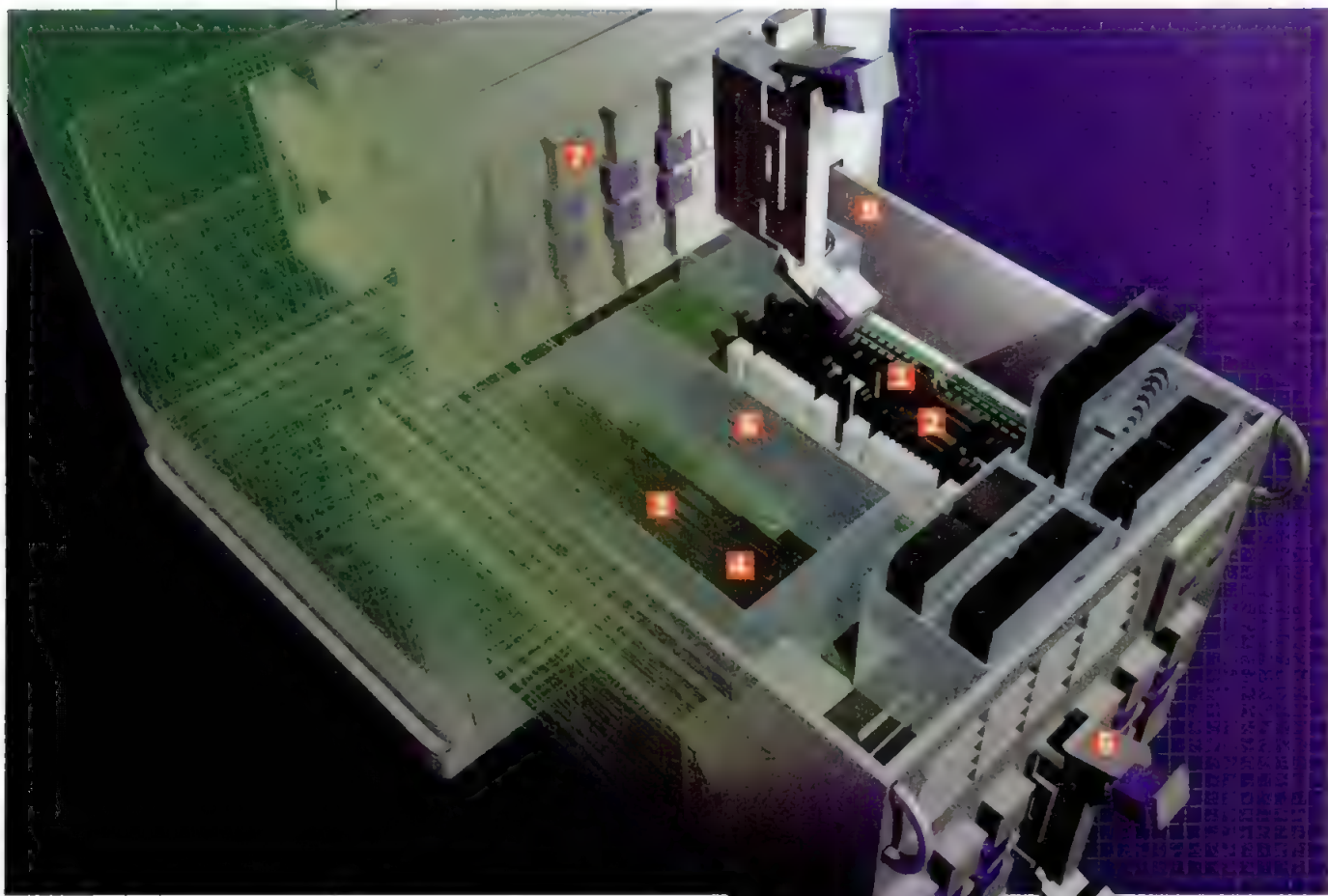
Our perfect **workgroup server** is less powerful and less redundant than our perfect enterprise server (described in detail below) but just as easy to manage and service. Used—for the most part—as a file, e-mail, Internet, or intranet server, it's a standalone tower with dual 550-MHz Pentium III processors—the variety with only 512K of secondary cache. As at the enterprise level, the server uses a dual-channel Wide Ultra2 SCSI-3 controller but includes up to five 18GB, 10,000-rpm SMART hard disks and only 256MB of SDRAM ECC memory. There is room, however, for up to 1GB of total memory.

Though 64-bit PCI slots aren't necessary with this system, it does include one shared ISA/PCI slot, three 32-bit PCI slots, and a 10/100 Ethernet card. Naturally, you can open the machine's chassis without tools, hot-swap its power supply, and easily remove or install its drives. But as with almost all of today's corporate systems, our perfect workgroup server's

most important offerings may be management software and a three-year warranty with on-site service. Speed hardly matters if your server is malfunctioning.

The four 550-MHz Pentium III Xeon chips in our perfect **enterprise server** can't yet match the performance of leading RISC or main-frame servers, but they'll certainly let you handle most of your important applications—including demanding tasks such as messaging, active Web page delivery, *enterprise resource planning* (ERP), and *online transaction processing* (OLTP), as well as file and print sharing, Web hosting, and other lighter tasks—with a single system.

These processors are accompanied by at least 2GB of SDRAM memory, a dual-channel Wide Ultra2 SCSI-3 RAID (Redundant Array of Inexpensive Disks) controller, and an external RAID Level 5 disk array with eight 18GB, 10,000-rpm hard disks. To help detect and correct hardware errors, all installed memory



FOR THE ENTERPRISE:

You Need...

- quad Pentium III Xeon/550 processors with 2MB L2 cache **1**
- 2GB SDRAM ECC memory, expandable to 8GB **2**
- eight hot-pluggable 64-bit PCI slots, one PCI/ISA slot **3**
- two 10/100 Ethernet cards or one gigabit card **4**
- seven front-accessible, hot-swappable drive bays **5**
- dual-channel Wide Ultra2 SCSI-3 RAID controller **6**
- external RAID Level 5 disk array with eight accessible hot-swappable 18GB hard disks **7**
- four hot-swappable power supplies **8**

\$65,000

offers ECC (error correcting code) technology, and all hard disks adhere to the SMART (Self-Monitoring Analysis and Reporting Technology) standard. These technologies insure reliability. With all the mission-critical applications that run on an enterprise server, it has to be as fault-tolerant as possible.

Ideally, the system's hard disks are hot-swappable, meaning you can add and remove them without shutting the system down. Like the machine's CPUs and fans, all hard disks and memory cards can be readily removed—without tools—from the front of the system. There's also room for up to 6GB of additional memory and at least two additional hard disks.

While including a competent graphics card and two 10/100 Ethernet cards (if not a Gigabit Ethernet card), our perfect enterprise server offers eight 64-bit PCI slots (which allow you to hot-swap cards) and at least one shared PCI/ISA slot for a modem or some other piece of legacy hardware. All of these slots are equipped with LEDs that indicate whether or not installed cards are operating properly.

All of this high-end hardware resides in a

bezel that you can quickly slide in and out of your existing server rack. The bezel is, as they say, rack-mountable. You should also be able to open this bezel without tools and easily add or remove drives from any of its seven front-accessible bays without tools as well. Like the system's hard disks and expansion cards, these drives and the system's four power supplies are hot-swappable. Each power supply, incidentally, has its own cord. As with RAID, the ECC technology, and the SMART standard, purpose drives design here: Four power supplies are necessary to boost the machine's fault tolerance.

To help you identify imminent failures and—if need be—repair or replace any of your hardware, our perfect enterprise server includes management software and is backed by a three-year warranty. The software predicts disk, memory, fan, CPU, and power supply failure, and the warranty includes a vendor promise of next-day, on-site repair service.

The third option, the **thin server**—or server appliance—is ideal for small businesses or

INSTRUCTIONS:

- 1. Cancel order for desktop printer.**
- 2. Order new HP LaserJet 1100A printer • copier • scanner.**
- 3. Attach Greeting Card.**
- 4. Deliver to end user.**

**Remove card
for instructions**

Introducing the HP LaserJet 1100A. It prints 8 pages per minute, makes copies, and even scans, so users can share documents via e-mail. All for just \$499*. It's perfect for an overworked special someone in your department. For a chance to win your own HP LaserJet 1100A, call 1-800-LASERJET Ext. 4105 or visit www.hp.com/go/lj1100a.



The HP LaserJet 1100A printer • copier • scanner

Speed (all functions) 8 ppm
Resolution (all functions)..... 600 dpi
Size (w x d x h)..... 14.5 x 15.8 x 14.9 in
Input Tray..... 125 sheets
OS Support..... Windows® 3.x, 9x, NT 4.0
Networkable via HP JetDirect

Scans directly to e-mail for easy document exchange. Includes integrated desktop software for organizing scanned documents and a professional version of OCR software for editing text.

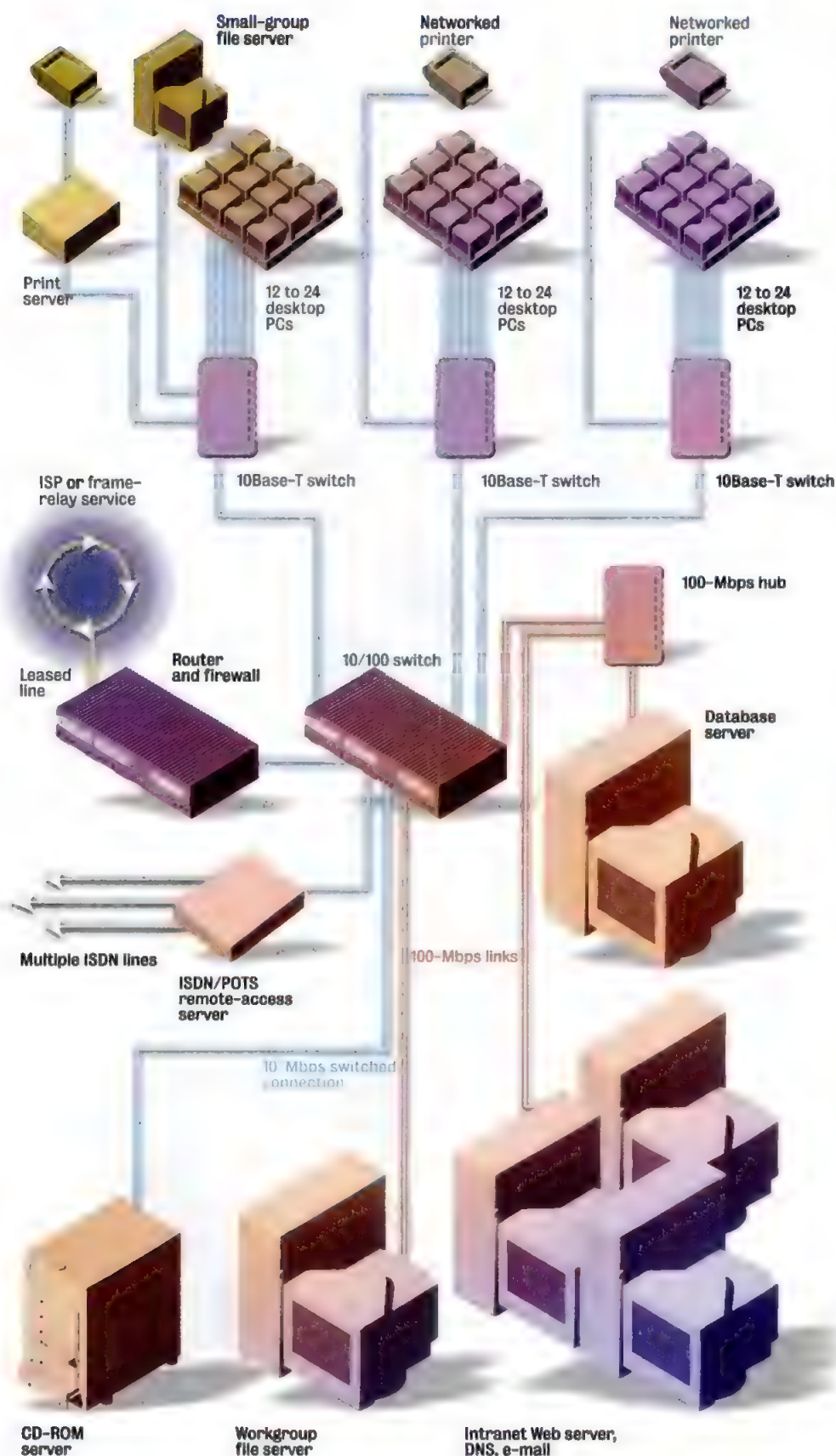
\$499*

The HP LaserJet 1100 printer

Easily upgradeable to the HP 1100A printer • copier • scanner thanks to HP JetPath technology. Simply add the copier/scanner accessory.

\$399*





Workgroup Network

Workgroup networks are typically more constrained by cost than by technology. The price of 10/100 Ethernet switches is below \$90 per port, however, and we think they belong in practically every workgroup. Most workgroups will have to plan for employee remote access, and a separate remote-access server makes sense for workers dialing in locally. Internet connections, Web site hosting, and firewall security are probably best left to an Internet service provider (ISP).

PC EDITORS' HOT LINKS

> ZDNet Products: Networking Products

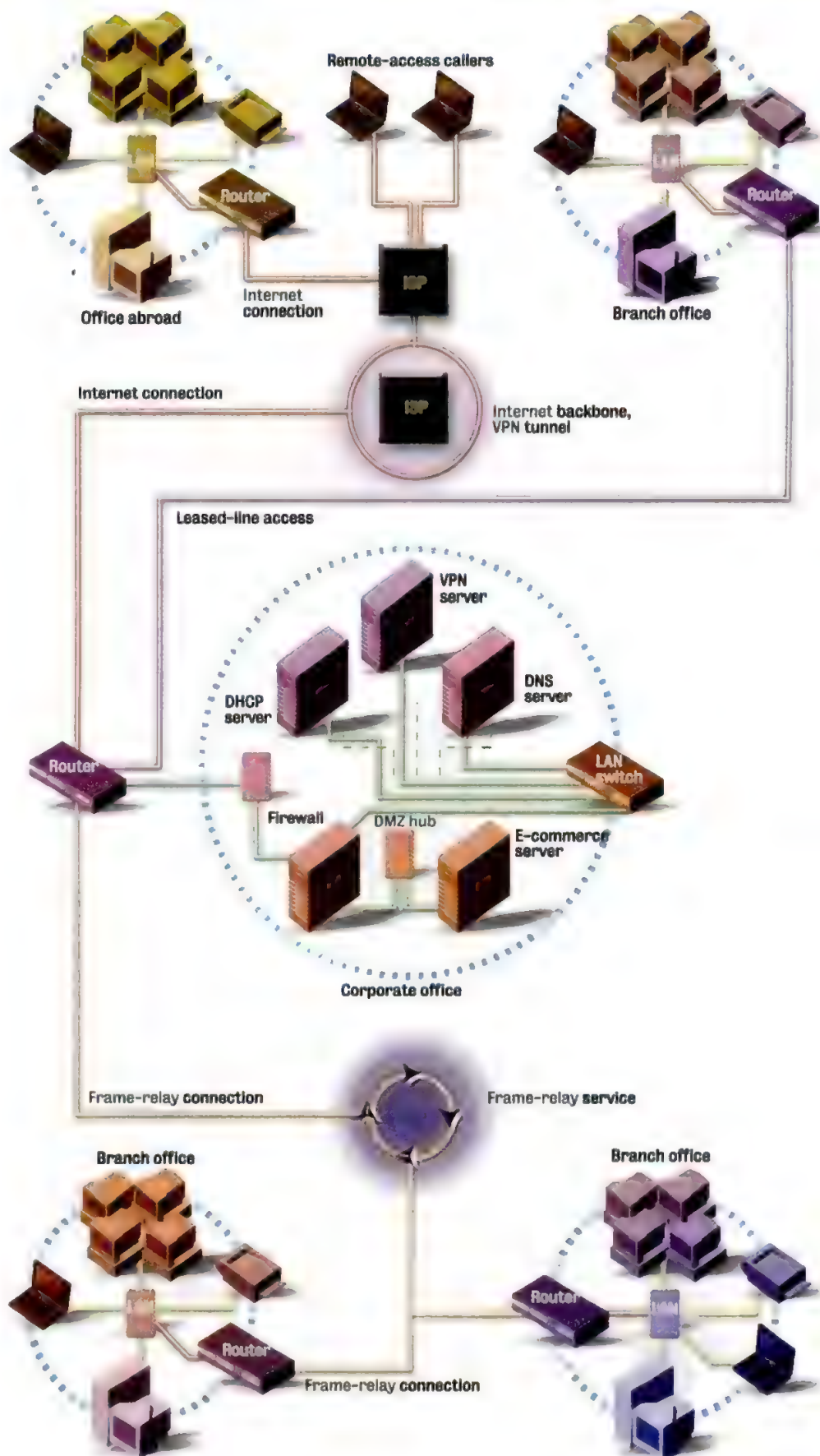
www.zdnet.com/products/networkmanager/server.html
The latest reviews, tips, and solutions dealing with servers and networking, from all of the Ziff-Davis publications.

> Intel Pentium III Xeon
www.intel.com/PentiumIII/Xeon/home.htm
Information on the Intel Pentium III Xeon processor, which is specifically designed for enterprise servers.

> Network Engineers Online
www.extracheez.com
Designed by network engineers for network engineers, this site is chock-full of reviews and tips.

Enterprise Network

The perfect enterprise network links workgroup LANs with frame-relay, leased-line, and VPN connections. Modern network devices provide extensive management reporting and control, and network managers should employ software distribution and desktop management services. The firewall, Web site, and any e-commerce services are highly technical and important, so enterprise managers should consider outsourcing them.



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THE NEXT 20 YEARS™

Moderated by Dan Farber

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NETSCAPE



RHICONSULTING
Technology Professionals

What is The Next 20 Years Series? Specific predictions and provocative debates on the future of technology from industry visionaries and analysts.... *A private cocktail reception and technology showcase*, featuring industry market leaders and emerging start-ups.... *An invitation-only* industry gathering, bringing together senior executives in technology, e-commerce, investment, media, advertising and design.... More innovative and creative people in one location than should be allowed at any one time.... Speakers will not only examine the *future of technology* but will prophesize about the key industries of each host city.

Now in its third year...the tour launched on *June 3rd in Los Angeles*, and included a look at the future of digital entertain-

ment... Then to *New York on July 29th*, where we will include a look at the future of money, and e-commerce....After NY, we head to *San Francisco, where on September 1st*, we will debate

the future of the technology industry itself... Then on to our last stop in '99: *London, where on September 29th*, we will debate the future of global communication and global e-commerce.

The series of debates will be *moderated by Dan Farber*, VP and Editor-in-Chief of ZDNet. Preceding and immediately following each debate will be a cocktail

reception featuring approximately *30 selected demos* from key technology sectors and live jazz. The current TNTY Technology series will expand next year into Medicine and Entertainment. The TNTY series is produced by Bob Ayres.

NEW YORK SPEAKERS, JULY 29TH, 5:30PM
Rockland Ballroom, 139 West 34th Street, NY

Ron Winkler,
Founder, Winkler Venture Partners

Paul Saffo,
Director, Institute for the Future

Moderator Dan Farber,
VP, Editor in Chief, ZDNet

A special guest to be announced!

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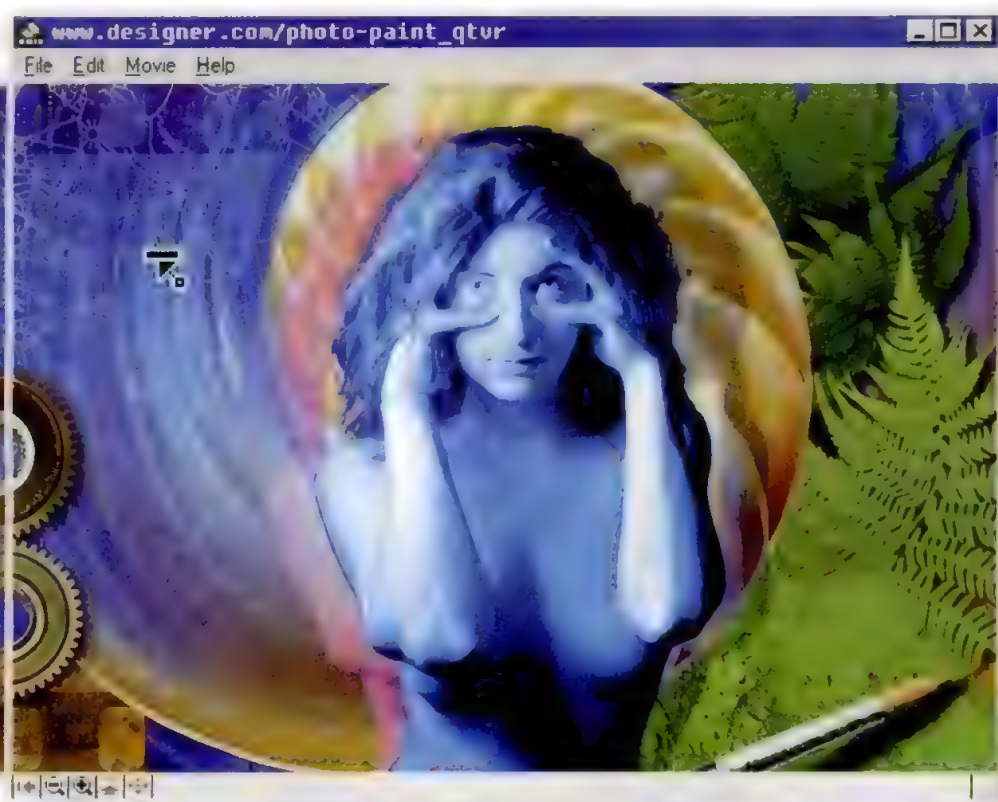
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Should You Outsource Important Network Services?

Outsourced service	PRO	CON
E-commerce site	• Lower setup expense. • Established credit card procedures. • Established security and privacy procedures.	• Higher long-term overhead. • Strong auditing controls required. • Uses service-level agreements to specify performance.
Firewall, security server, directory server	• Provides needed expertise for arcane technology. • Provides expertise for handling high-risk scenarios.	• Potential for disputes over liability if the system is compromised. • Strong controls over security required.
Enterprise/corporate e-mail service	• A commodity service available at a good cost savings. • Time-consuming, so better left to experts to do on a large scale.	• Strong controls over privacy and security required. • Uses service-level agreements to specify performance. • Growth can trigger higher cost brackets.
Enterprise resource management software	• Provides needed expertise for arcane software. • Can handle complex hardware and network requirements. • Lower setup expense.	• Installation can take months because of all the administration and procedures. • Potential for higher long-term costs. • The number of vendors or services is hard to change once you are set up.

branch offices. Such units generally consist of an embedded OS (usually Unix), with the Internet connection and Web and e-mail servers managed through a browser, network-connected hardware, a hard disk, a CPU, routing software, and an Internet connection (commonly a modem). Thin servers are well suited to small-business environments because of their quick deployment and low cost of ownership. Although the initial cost of the server is low, the real savings comes in the ease of management and administration.

The perfect thin server offers a wide range of services, including Web, FTP, DHCP, configurable firewall/proxy, e-mail, and optional remote access and VPN support. Cross-platform file serving lets Macintosh and Windows clients easily drag and drop data to public or private directories on the device. Ideally, the unit will be scalable to ISDN, DSL, cable, and full T1 bandwidths.

The Perfect Network

"Affordable and truly sophisticated"—these are terms one typically associates with the fashion industry, but they also fit today's networking market very well. Modern networking products do a lot more for a lot less. Competition among Bay Networks, Cisco, HP, Intel, and 3Com has driven the per-port cost of 10/100 switches with management capabilities to below \$90. Today's perfect network uses switching at every level, even in workgroups, because upcoming audio and video applications will create traffic loads that can cause congestion in

simple network hubs without switching. The enterprise network features management reports from every piece of equipment, from the LAN adapter to the router.

The perfect enterprise network combines proven technology with a conservative dose of leading-edge components. Long-established frame-relay service, along with some leased lines, remains at the heart of the enterprise WAN. But the relatively new *virtual private network* (VPN) services offer such economy that they've quickly won a place in most enterprise networks. A VPN is a network that exists "virtually" on public wires used for many other purposes. Though the wires are public, your data is protected through encryption and other security mechanisms. Many software packages let you use the Internet as the medium for your VPN. VPNs offer corporate LAN-to-LAN connections, remote access for employees, and extranet service connections. VPNs haven't completely replaced remote-access servers—local employees are probably better off calling into such servers—but VPNs are particularly valuable for reaching more distant employees.

Some other leading-edge developments, including Version 6 of the Internet Protocol (IPv6) and directory services, haven't been accepted as quickly as VPN technology and haven't yet made it into our perfect network. IPv6 is still waiting in the wings, as it has been for several years, to meet an anticipated but unfulfilled need for a data-prioritization scheme labeled *quality of service* (QOS). The deployment of directory services awaits the outcome of the marketing battle about to flame



User Tips

WORKGROUP SERVERS

✓ **Eternal vigilance.** Getting the most from your equipment and providing the best service to your users requires frequent recharacterization of your network and server load.

✓ **Manage the right thing.** The most important management indicators are memory utilization, page swapping, and disk drive utilization.

✓ **Give it a straight shot.** Pair the server's 100-Mbps Ethernet adapter with a 100-Mbps port on a network switch.

ENTERPRISE SERVERS

✓ **Keep it quiet and cool.** Give your server a space with extra environmental control.

✓ **Out-of-band management.** For far-flung servers at remote locations or to avoid weekend service calls, consider a management card that will let you reboot your machine with a simple phone call.

✓ **Benchmark.** Periodically run benchmark tests on your servers to make sure they are consistently performing the way they should.

Authentication Options

OPTION (COST)	HOW IT WORKS	PROS	CONS	BEST FOR
Password (free)	A user's text phrase is authenticated against a database of qualified users.	Well-known system—the current standard.	Can be cumbersome to manage; relies entirely on user knowing the password.	Small organizations with less stringent security needs.
Token (up to \$100 per seat)	A user's small device calculates a response, given a challenge from the authentication service. Works with a user name and password to log on to a network.	One-time passwords; no device is physically connected to the client computer.	Expensive; users have to carry the tokens (which can be lost and are inconvenient); can be confusing to users.	Remote access and higher-security LANs.
Smart card (\$100 per seat)	A user's credit card-size device with user-specific information (such as a digital certificate) encoded onto an embedded integrated circuit.	Can keep info on the card and not on the central site; no password to snoop; can easily be layered with other authentication techniques; inexpensive.	Users have to carry the devices; if stolen, no way of entering a PIN; if lost or stolen, could be used by someone else.	Medium-security environments that need quick authentication; should be layered with another authentication method.
Fingerprint (\$99–\$299 per seat)	A user's fingerprint or a subset of important fingerprint characteristics called minutiae is compared with a previously enrolled print or set of minutiae points.	Authentication is quick and administration is simplified; fingerprint scanners are inexpensive.	User misconception that employers now have their prints on file; fingerprints are dynamic and authentication may become more difficult over time.	Low-security organizations that want to save money; high-security organizations that use prints in conjunction with passwords to create two-factor authentication.
Voice (\$50 per seat)	Key parts of a user's voice pattern are compared to a previously sampled set of phrases to determine a user's identity.	Requires only low-cost hardware and can work for mobile users.	May not work in noisy environments, and may not identify a user's voice changed, for example, by sickness.	Mobile situations and in conjunction with telecommunication applications.
Eye scan (\$500 per seat)	Blood vessel patterns inside the eye or the pattern of the user's iris is compared with previously enrolled images.	One of the most accurate biometric devices and one of the hardest to fool.	Expensive, and may not work for the blind or people with cataracts.	Highly sensitive systems and for providing authentication for physical access.
Face recognition (\$39–\$199 per seat)	User's facial images obtained through a camera are run through algorithms and compared with previously enrolled images.	One of the least intrusive authentication technologies; users can be recognized before they've taken their seats.	Some systems can be fooled by a photograph.	Low-security situations where easy client authentication is important, or high-security areas where it can be layered with other authentication methods.

between Microsoft and Novell.

Everything old is new again, and outsourcing—called “time sharing” back in the 1960s and 1970s—is again a legitimate and desirable way to take advantage of Web site hosting, e-commerce, e-mail, and even online applications for both workgroups and large enterprises. Our enterprise diagram shows an on-site Web server and firewall, but those services along with key applications like enterprise resource management programs can be contracted from a carrier. The server and Internet devices can reside physically with the enterprise and be managed by contracted specialists, or everything can reside in the outsourcing company's data center. Outsourcing these highly technical services—or in some cases commodity services like e-mail—reduces the load on IS personnel and lets enterprise managers concentrate on their primary business.

Even with some outsourcing, every business network is a potent and expensive resource that deserves sophisticated management. Modern network equipment offers reporting and control through both the Simple Network Management Protocol (SNMP) and the Man-

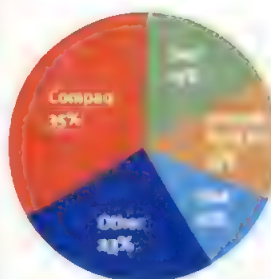
agement Information Base (MIB) all the way to the desktop. Today, special network management console programs have been overcome by the ubiquitous browser. Practically every network and desktop device has a browser interface for management. Efforts to control *total cost of ownership* (TCO), once highly hyped, have evolved into the use of software distribution across the network, sophisticated help-desk analysis software, and desktop controls to limit user-inflicted problems. A perfect enterprise network provides the IS staff with packages of management tools that report on status, control equipment functions, and assist desktop users.

Whether they're outsourced or built in-house, the firewall, DNS, and other Internet-related services demand highly reliable hardware. Appropriate hardware configurations are shown in the workgroup and enterprise illustrations.

The unconnected computer and the unconnected business both fail to reach their full potential. Today, workgroup and enterprise networking brings e-business and conventional business together. **PC**

Top PC Server Vendors

A few major vendors account for most of the market.



Figures are 1998 U.S. unit shipments.

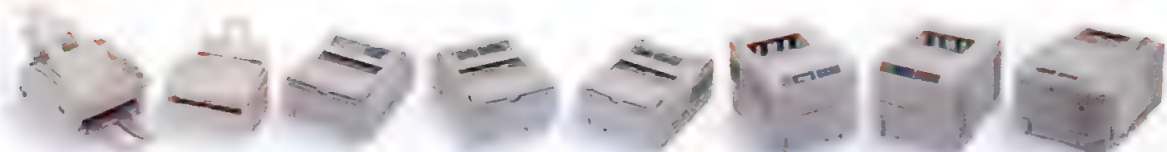
Source: International Data Corp., May 1999 (www.idc.com).

WHAT'S THIS YEARS SMARTEST LINE ON PRINTING?



“

”



OKIOFFICE 84

OKIPAGE 8w

OKIPAGE 10e

OKIPAGE 10ex

OKIPAGE 12i

OKIPAGE 18

OKIPAGE 24DX

OKIPAGE 8c

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OKI provides the most comprehensive line of Digital LED business printing solutions for the desktop and the network, as well as faxes and MFP's. All of which makes the new OKI Digital LED line the smartest choice for small to medium sized businesses.

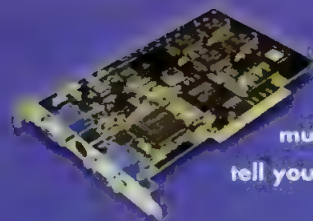
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Ask anyone who's experienced the joy of multiple monitors and they'll tell you — one isn't enough.

*“Yes. Yes,
Oh God,
YES.”*

Why? Because your job demands multiple tasks, and that leads to **overcrowded desktops**. You can keep several windows open, hunting and clicking between them — what a drag. Or you can try to focus on just one at a time, which limits you to a single train of thought. Either way, your work slows down and you are less productive.

But multiple monitors give you **room to work** with all those applications. You can keep a large window on one screen for the most important things you're working on. And use the other for toolbars, menus and other applications. Or keep a web browser open so you can stay current on events.

Best of all, this solution — buying a second monitor and card — will give you more room and **cost less than upgrading** to a bigger monitor.

(Multiple is better.)



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Desktops & Notebooks SERVICE & RELIABILITY

IN OUR 12TH SURVEY, PC MAGAZINE SUBSCRIBERS RATE DESKTOP AND NOTEBOOK VENDORS ON THE SUPPORT THEY PROVIDE.

By Bill Howard, Josh Levy, and Monique Mehta

Report Card

DESKTOPS—OFFICE USE

A Dell
Hewlett-Packard
IBM

B Gateway
Micron

C Apple
Compaq
Digital
NEC
Toshiba
Locally built

D Acer
Packard Bell

E AST

DESKTOPS—HOME USE

A Dell
IBM

B Apple
Micron
Quantex

C Gateway
Hewlett-Packard
NEC
Sony
Toshiba
ZEOS
Locally built

D AST

E Acer
Compaq
Packard Bell

For some vendors we did not receive 50 responses pertaining to a given subcategory (the minimum required for inclusion in our charts).

JUST AS ALL PCs AREN'T ALIKE inside the box, all computer companies aren't the same when it comes to service and reliability. Most vendors boast of their generous warranty policies and stringent quality controls, but to separate the heroes from the followers, you need to look at customer satisfaction and repair records. Our annual Service and Reliability Survey helps make this easier. By examining system repair frequency and customer support experiences from a range of *PC Magazine* readers, we reach statistically valid judgments on how individual vendors are performing—and the results are sometimes surprising, not to mention helpful for comparison shoppers.

Because of the growth of the home PC market—more than half of all U.S. households now have computers—*PC Magazine* this year reports separate grades for desktop PCs used in the office and those used in the home, in addition to the overall grades for desktops and the grades for notebooks. (The home notebook market isn't yet big enough to merit a breakout.)

WHO'S UP, WHO'S DOWN

The news this year is surprising in some cases and in others is just a continuation of a trend. IBM has earned yet another top position: Big Blue may have

its ups and downs maintaining desktop market share, but for service and reliability it stands alone. IBM is the only vendor to receive a grade of A in every category: desktop office PCs, desktop home PCs, desktop PCs overall, and notebook PCs.

Other manufacturers with A's are Dell for both office and home desktops, Hewlett-Packard for office desktops, and Sony, a newcomer to the mobile market, for notebook PCs—an impressive debut. Quantex, which has improved steadily since its first appearance on this survey in 1997, gets an A in the overall desktop category. Notebook grades for Dell and Gateway—both A's last year—have dropped to B's.

Though Compaq is the number-one seller of home PCs both in the U.S. and worldwide (with 14 percent market share domestically), it's one of the lowest scorers. Compaq receives an E for home PCs, as do Acer and former market leader Packard Bell (now with 13 percent of the U.S. market). AST receives the lone grade of E for office PCs.

ABOUT THE SURVEY

In January, we mailed surveys to 17,000 *PC Magazine* subscribers, asking them for their opinions on the quality of service and technical support they have received from PC vendors

Report Card

DESKTOPS—OVERALL USE

A Dell
IBM
Quantex

B Apple
Hewlett-Packard
Micron
Sony

C AT&T
CompuSA
Digital
Gateway
NEC
Toshiba
Zenith Data Systems
ZEOS
Locally built

D AST
Compaq
MidWest Micro

E Acer
Packard Bell

Our Contributors: BILL HOWARD is the senior executive editor of *PC Magazine*, and JOSH LEVY is a staff editor. MONIQUE MEHTA is the research manager at *PC Magazine*, and JENNIFER TRIVERIO was the associate editor in charge of this story.



Desktops: Dell, IBM, Quantex Notebooks: IBM, Sony

Whether the buyer is the largest of corporations or an individual purchasing a single system for the home, the importance of a vendor's service and support policies and programs is paramount. This year, *PC Magazine* subscribers award top honors to three desktop vendors and two notebook vendors.

In the desktop category, IBM receives an A for the seventh straight survey and Dell garners its fourth consecutive A. Quantex, continuing its impressive improvement since debuting in our survey three years ago, breaks into the A category. After four straight B's, IBM earns an A in the notebook category, while Sony's notebooks make a splash—earning an A in their first year in the survey.

To earn a grade of A and thus merit a Readers' Choice award, a vendor must be ranked better than average on all four of our key questions: satisfaction with reliability, satisfaction with repair experience, satisfaction with technical support, and the

number of units that have had to be repaired in the past 12 months (repair frequency). These scores determine the vendor's grades, from A to E. Though we didn't have any E performers last year, this year Acer and Packard Bell drop from D's to E's in the desktop category, and AST falls from a D to an E in the notebook category.

The area that proves most problematic for both desktop and notebook vendors is repairs—both repair frequency and satisfaction with the repair experience. These categories hold Hewlett-Packard and Micron to B's in the desktop division and Dell, Gateway, and Micron to B's in the notebook division.

Though only a select few vendors receive A's and deserve special note, don't discount the vendors that get B's and C's, as they are also providing above-average or satisfactory support.

For information on our testing procedures, please see the sidebar "How We Surveyed."

over the past two years. We closed the survey in March once we had received a 50 percent response rate—a standard level of statistical weight. Readers could evaluate up to three desktops and three notebooks each, and the survey yielded ratings of some 17,300 desktops from 21 vendors and of about 4,700 notebooks from 17 vendors.

This is our twelfth survey; the first was published in 1990, and since 1995 the survey has been an annual event with a consistent methodology. We ask respondents to rate vendors on 11 questions about desktops and notebooks, 4 of which count toward our letter grade. These 4 main questions are:

- the number of units that have needed repair over the past 12 months (we use the term *repair frequency* here to distinguish this category from *repair satisfaction*);
- satisfaction with reliability;
- satisfaction with repair experience (*repair satisfaction*);
- satisfaction with technical support.

We also ask readers whether they'd buy again from the same vendor. This question is a good overall indicator of reliability, satisfaction, price-competitiveness, and the manufacturer's viability.

In addition, we ask how much time users spent on hold when calling technical support and what happened when a technician was reached: whether the problem was solved over the phone or the unit was sent out for repair, for example. We also ask how users feel about their repair experience, including

whether they would rate the technicians as knowledgeable or whether they feel they got a runaround. These additional insights into subscribers' experiences are reported in the tables headed "Repair/Support Scores."

The results of the current survey include user data on seven vendors that either are out of business, have merged into another company, or are between owners: AST, AT&T, Digital, Texas Instruments, Zenith Data Systems, and ZEOS.

This year we are also

tabulating results for locally built or "white-box" systems. Interestingly, this is the largest group in our survey, representing one in five desktop systems.

DERIVING LETTER GRADES

We arrive at our vendor grades through a straightforward set of definitions:

A—The vendor achieves better-than-average scores on all four key measures: repair frequency within the last 12 months, satisfaction with reliability, satisfaction with repair experience, and satisfaction with technical support.

B—The vendor has a mix of better-than-average and average scores on the four key measures.

C—The vendor has average scores on all four measures, or (in a few cases) a combination of better-than-average and worse-than-average scores.

D—The vendor has a mix of worse-than-average and average scores.

E—The vendor receives worse-than-average scores on all four key measures.

WHAT WE FOUND

Readers generally give higher marks to home PCs than office PCs. We believe that's because office systems are more complex thanks to networking issues, which can lead to repair and support hassles. (Few home users are unable to print

Report Card

NOTEBOOKS—OVERALL USE

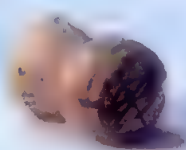
A	IBM Sony
B	Compaq Dell Gateway Micron Toshiba
C	Acer Apple Digital Fujitsu Hewlett-Packard Hitachi NEC
D	Texas Instruments WinBook
E	AST

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ADR.

because of a bad network card, for example.) Most vendors' home scores are about half a point higher on the 1-to-10 scale used for our key measures of satisfaction, and home repair frequency scores are 4 percentage points better—30 percent versus 34 percent.

As in the past, the biggest challenge for vendors is repair frequency within the previous 12 months. This year, only five desktop and three notebook vendors score better than average in this category, and several vendors receive a B instead of an A only because they can't hit the better-than-average mark on this measure. That may be because manufacturers often use common parts; it's hard for any single vendor to acquire components that have a markedly different level of reliability.

Despite this challenge, our survey shows that users are generally satisfied with their systems. Repair frequency scores have improved this year: The average for both desktops overall and notebooks is now 31 percent, down from last year's 35 percent. These numbers reflect more than just physical failures; vendors couldn't stay in business if one in three systems needed repair service each year. We believe the score includes setup, configuration, and networking issues that require service or support. The general improvement suggests to us that manufacturers that don't improve their reliability and customer support risk falling behind by standing still.

Here's a more detailed look at how companies fared, concentrating on the major vendors still actively selling PCs.

THE VENDORS: A CLOSER LOOK

Acer's high point in *PC Magazine's* Service and Reliability Survey was in January 1995, when it posted a grade of B, and its significance in the market peaked in 1996 with the Aspire line of home PCs. Now Acer's on the ropes, with a low grade of E for its primary market of home desktop PCs. The company has informed us of a parts shortage it experienced last summer; it has since implemented a new service management system. These changes may positively affect next year's grades.

Apple fares better at the home than in the office (B versus C), and its desktops

PC Vendor Scores: Office and Home Desktops

Four scores contribute to the vendors' grades: the number of units needing repair over the past 12 months and the three measures of satisfaction. The question about the likelihood of buying the same companies' products again is included to give additional insight into *PC Magazine* subscribers' perceptions of vendors.

	Units needing repair over the past 12 months	Satisfaction with reliability	Satisfaction with repair	Satisfaction with tech support	Buy again?
● Significantly better than average					
● Average					
● Significantly worse than average					
OFFICE USE					
Acer (141 responses)	40%	7.0	6.4	5.9	5.1
Apple (105)	31%	7.9	7.3	7.0	6.0
AST (91)	47%	6.9	6.3	5.9	4.1
Compaq (1,190)	38%	7.8	7.0	7.1	6.3
Dell (1,618)	28%	8.8	8.5	8.4	8.5
Digital (133)	37%	8.0	6.8	6.8	4.9
Gateway (1,135)	34%	8.6	8.1	8.0	7.9
Hewlett-Packard (523)	29%	8.2	7.4	7.4	6.8
IBM (698)	27%	8.3	7.5	7.6	6.6
Micron (378)	35%	8.4	7.9	7.8	7.5
NEC (81)	35%	7.8	7.2	6.7	5.3
Packard Bell (88)	44%	6.4	5.6	5.3	4.2
Toshiba (84)	35%	8.1	7.1	6.7	6.9
Locally built (996)	42%	8.0	7.8	7.5	6.7
AVERAGE	36%	7.9	7.2	7.0	6.2
HOME USE					
Acer (206 responses)	39%	7.6	6.8	6.2	5.6
Apple (91)	15%	8.6	7.9	7.5	7.5
AST (99)	24%	7.5	6.8	6.6	5.1
Compaq (597)	35%	8.1	7.0	7.0	7.1
Dell (1,216)	24%	9.2	8.7	8.7	9.2
Gateway (1,602)	34%	8.8	8.4	8.1	8.4
Hewlett-Packard (316)	29%	8.4	7.4	7.5	7.5
IBM (458)	25%	8.6	7.9	7.8	7.6
Micron (587)	33%	8.9	8.4	8.2	8.4
NEC (93)	32%	8.4	7.9	7.1	6.8
Packard Bell (373)	36%	7.1	6.0	5.3	4.7
Quantex (110)	24%	8.8	8.2	8.0	8.3
Sony (57)	30%	8.6	7.9	7.6	6.8
Toshiba (85)	27%	8.1	7.2	6.8	6.7
ZEOS (161)	22%	8.3	7.4	6.7	4.5
Locally built (2,359)	36%	8.5	8.3	7.8	7.6
AVERAGE	29%	8.3	7.6	7.3	7.0

Scores for AT&T, CompUSA, Digital, MidWest Micro, Quantex, Sony, Zenith Data Systems, and ZEOS are absent from one or both of these desktop subcategories because those vendors received a statistically insufficient number of responses for inclusion.

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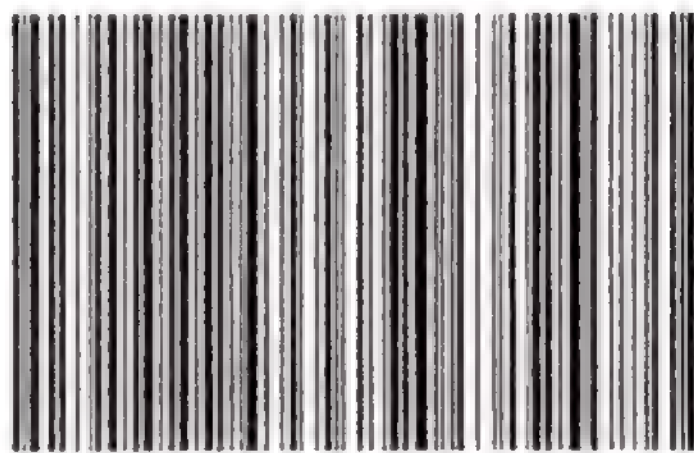
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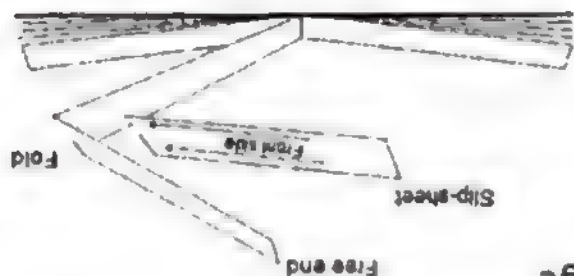
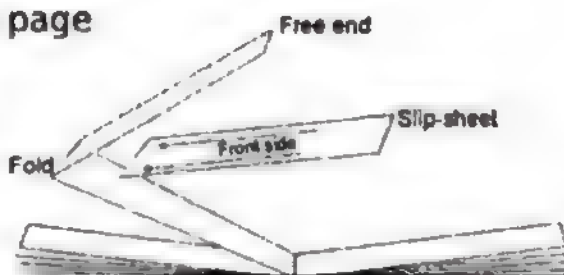


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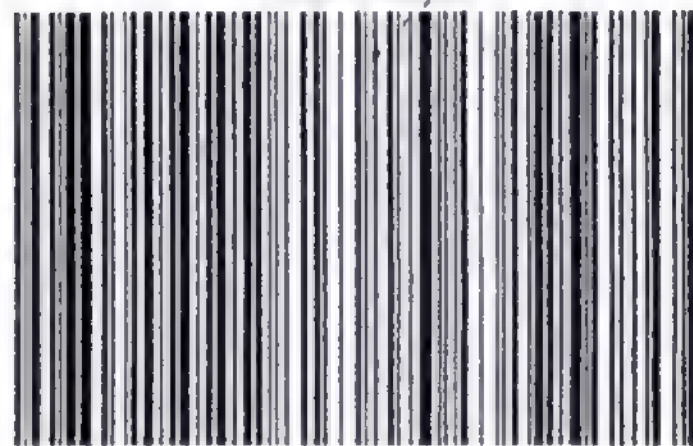


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Inverted Back

1. Follow instructions on the other side



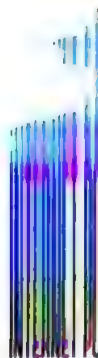
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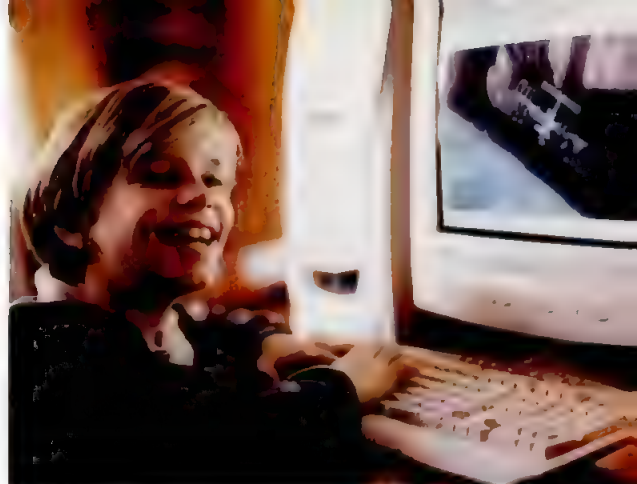
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13.3" TFT Active Matrix Display
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Repair/Support Scores: Office and Home Desktops

	REPAIR EXPERIENCE (among those needing repairs)							TECH-SUPPORT EXPERIENCE (among those using technical support)				
	Time on hold (minutes)	Problem solved over the phone	Sent new part	Fixed on-site	PC was sent out for repair	Got a new PC		Got run-around	Tech was knowledgeable	Tech tried everything to help	Prompt resolution	More than one call to resolve
OFFICE USE												
Acer (141 responses)	13.2	9%	21%	35%	25%	5%		29%	19%	10%	26%	33%
Apple (105)	22.1	24%	21%	36%	21%	3%		15%	50%	38%	41%	38%
AST (91)	19.1	28%	19%	30%	26%	5%		24%	36%	30%	27%	33%
Compaq (1,190)	13.5	17%	25%	43%	18%	6%		17%	33%	25%	26%	36%
Dell (1,618)	8.9	32%	41%	34%	5%	3%		6%	49%	42%	49%	22%
Digital (133)	13.2	18%	27%	43%	20%	8%		16%	40%	33%	37%	37%
Gateway (1,135)	12.0	39%	51%	18%	8%	2%		10%	49%	43%	41%	28%
Hewlett-Packard (523)	13.2	27%	29%	36%	15%	5%		9%	44%	30%	37%	30%
IBM (698)	9.3	15%	29%	45%	18%	5%		11%	38%	33%	37%	23%
Micron (378)	11.8	39%	49%	18%	11%	2%		8%	50%	35%	49%	27%
NEC (81)	6.8	11%	14%	46%	21%	4%		6%	44%	28%	33%	22%
Packard Bell (88)	34.4	18%	13%	36%	21%	8%		27%	24%	24%	19%	49%
Toshiba (84)	9.6	17%	17%	21%	38%	14%		24%	32%	24%	28%	36%
Locally built (996)	10.9	17%	20%	36%	21%	4%		5%	37%	37%	42%	27%
AVERAGE	14.1	22%	27%	34%	19%	5%		15%	39%	31%	35%	32%
HOME USE												
Acer (206 responses)	13.2	34%	25%	6%	29%	4%		17%	31%	27%	14%	36%
Apple (91)	6.9	29%	14%	N/A	43%	7%		9%	36%	64%	55%	18%
AST (99)	11.4	17%	25%	29%	46%	8%		25%	25%	32%	32%	43%
Compaq (597)	13.4	32%	20%	19%	27%	3%		17%	36%	34%	31%	37%
Dell (1,216)	9.1	44%	32%	28%	6%	1%		5%	57%	49%	58%	22%
Gateway (1,602)	12.3	50%	50%	8%	9%	2%		9%	54%	49%	46%	30%
Hewlett-Packard (316)	13.6	37%	14%	16%	34%	4%		15%	38%	39%	38%	30%
IBM (458)	10.1	27%	27%	12%	30%	1%		16%	41%	39%	38%	25%
Micron (587)	12.3	34%	54%	10%	11%	4%		6%	58%	49%	53%	26%
NEC (93)	10.0	43%	13%	17%	40%	7%		20%	40%	40%	44%	24%
Packard Bell (373)	18.6	33%	9%	13%	31%	1%		24%	30%	28%	23%	49%
Quantex (110)	11.4	42%	46%	8%	12%	N/A		2%	58%	53%	60%	16%
Sony (57)	13.3	53%	29%	12%	12%	6%		16%	40%	36%	40%	36%
Toshiba (85)	16.1	13%	13%	22%	52%	N/A		32%	42%	26%	23%	36%
ZEOS (161)	11.4	40%	26%	3%	40%	3%		16%	68%	46%	35%	32%
Locally built (2,359)	9.9	20%	25%	13%	28%	1%		8%	42%	35%	40%	26%
AVERAGE	12.1	34%	26%	13%	28%	3%		15%	44%	40%	39%	30%

N/A—Not applicable: There were no responses for this question.

Scores for AT&T, CompUSA, Digital, MidWest Micro, Quantex, Sony, Zenith Data Systems, and ZEOS are absent from one or both of these desktop subcategories because those vendors received a statistically insufficient number of responses for inclusion.

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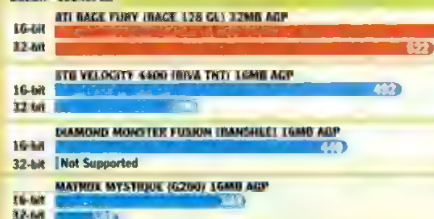


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No compromise performance with 32-bit color

overall fare better than its notebooks (again, B versus C). Most notable is the company's excellent 15 percent repair frequency for home users during the past 12 months—only half as many repairs as the average. Credit probably goes to a combination of the Macintosh operating system's ease of use, the relatively forgiving SCSI bus used for Apple peripherals, and the company's perfection of plug-and-play upgrades, most recently with USB replacing other I/O ports. Note that this repair-frequency excellence does not carry over to Apple's office PCs or notebooks, both of which score within the average range.

Historically, **AST** has earned disappointing scores in this survey, and this year its notebook score drops from D to E. AST's buy-again scores stand out as the worst among all vendors still in the PC business. AST went through a major transition this past winter, however, its assets having been sold by Samsung to a group led by ex-Packard Bell CEO Beny Alagem. The new AST has revamped its entire operations from manufacturing to technical support, and has replaced its engineering team.

Compaq's notebook grade climbs from D to B this year, thanks to a much-improved score for satisfaction with system reliability. The company attributes the progress to better engineering and more systematized quality control during the manufacturing process.

Compaq's desktop grade goes in the opposite direction, from B to D, with a split between office systems (C) and home systems (E). The home score is a study in contrast: Despite the E grade, users report an above-average likelihood of buying from the company again.

Ironically, Compaq's numeric scores on the four key measures that make up the grades are better for home desktops than for office systems (see the chart "PC Vendors Scores: Office and Home Desktops"). So why do Compaq home PCs get a lower grade? Because our grades are based on how a vendor performed relative to the group average—and for home PCs the group average is at a higher level than for office PCs, making it harder for a vendor to stand out from the pack in that category. Thus, the same scores that would be consid-

ered average for office PCs may be below the average for home PCs.

Compaq has recently added some new components to its support setup, including a knowledge database for troubleshooting problems (currently available only to service technicians, but this database should be accessible to everyone via the Internet by the end of the year). Also, an application called Service Connection automatically updates drivers and BIOS information for Compaq Presarios.

Dell, the king of direct sales, just misses a triple crown. It earns A's for both office and home desktops but a B for notebooks. (Dell received an A for notebooks last year; it slips this time around because its score for repair frequency drops from better-than-average to average.) Dell gets high scores for quick phone support and prompt problem resolution; customers who need support are generally kept on hold for less than 10 minutes (the average is between 12 and 14 minutes). Equally significant, its buy-again scores on our survey are the best in the industry.

Notebook maker **Fujitsu** makes its debut into our survey with a C this year. Its score for average time on hold is the longest of all the notebook vendors, at over 20 minutes. Readers also indicate that Fujitsu is the notebook vendor most likely to give customers a runaround (36 percent—twice the average).

Gateway's raw scores for home and work desktops are similar to each other, but they land in different grade territory because of the group averages: a B for work and a C for home. (The overall desktop grade is C.) Gateway notebooks manage a B this year—a drop from last year's A—owing to an average score for recent repairs. On every other measure, Gateway notebooks prove better than average; the company's technical-support personnel are among the least likely to give customers a runaround.

Hewlett-Packard gets an A for its office PCs but only average grades (C's) for home PCs and notebooks. Users of office desktops say that HP is not likely to give them a runaround on the phone (half the average, or 9 percent, do say they get a runaround), while home users give HP an average score (15 percent).

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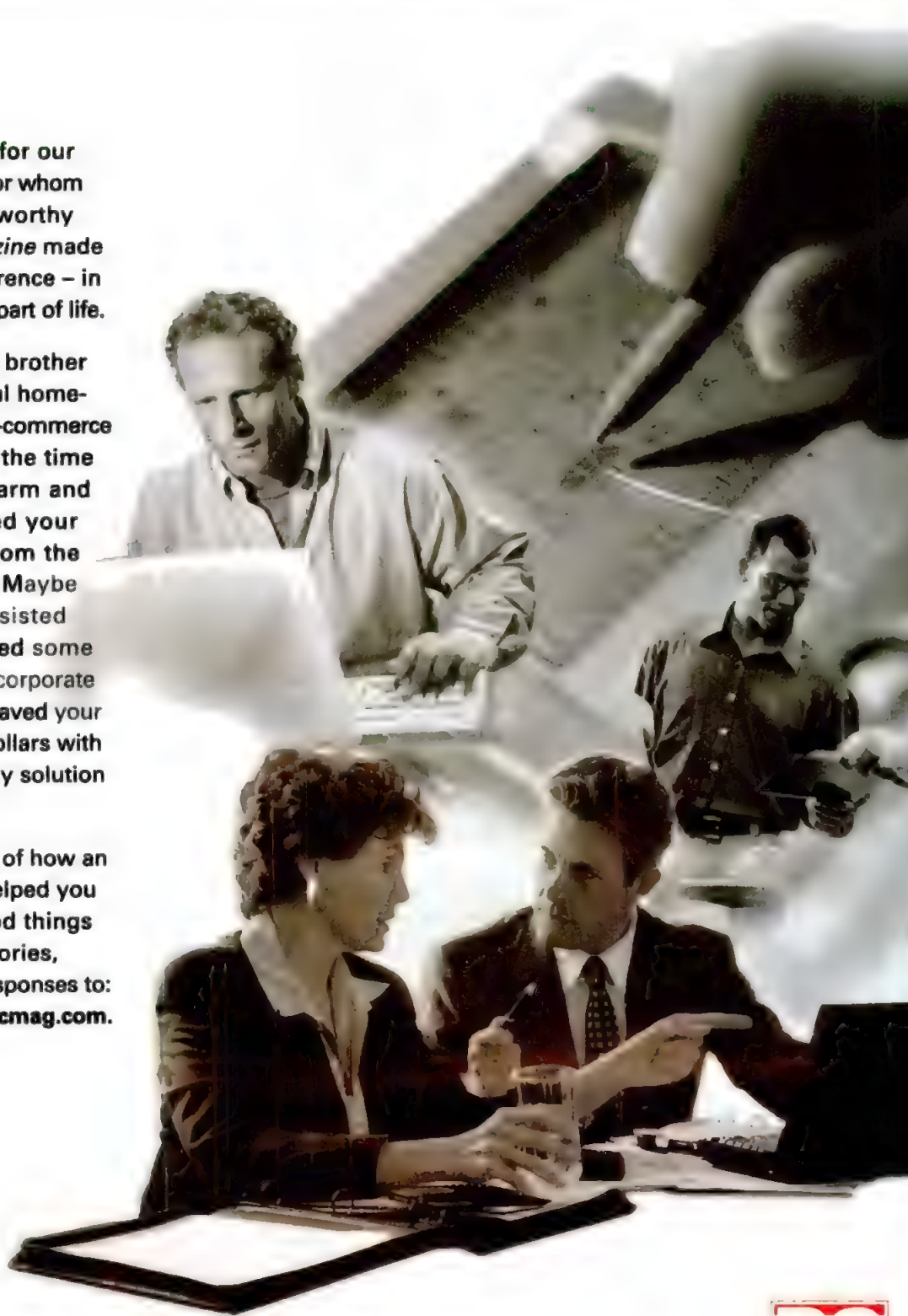
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PC Vendor Scores: Desktops vs. Notebooks

- Significantly better than average
- Average
- Significantly worse than average

DESKTOP VENDORS—OVERALL USE

	Units needing repair over the past 12 months	Satisfaction with reliability	Satisfaction with repair	Satisfaction with tech support	Buy again?
Acer (381 responses)	38%	7.4	6.7	6.1	5.4
Apple (224)	23%	8.2	7.6	7.3	6.8
AST (207)	34%	7.3	6.6	6.4	4.8
AT&T (77)	30%	7.9	7.3	6.7	4.2
Compaq (1,910)	36%	7.9	7.1	7.1	6.6
CompUSA (53)	34%	8.0	7.2	7.0	6.3
Dell (3,029)	26%	9.0	8.6	8.5	8.8
Digital (186)	36%	8.1	7.1	7.2	5.1
Gateway (2,958)	34%	8.7	8.3	8.1	8.3
Hewlett-Packard (884)	29%	8.3	7.4	7.4	7.1
IBM (1,256)	25%	8.5	7.7	7.7	7.1
Micron (1,040)	33%	8.7	8.3	8.1	8.1
MidWest Micro (61)	46%	8.1	7.8	7.1	6.4
NEC (185)	35%	8.1	7.6	6.9	6.1
Packard Bell (500)	36%	6.9	6.0	5.4	4.7
Quantex (146)	23%	8.7	8.3	8.0	8.2
Sony (70)	27%	8.5	7.5	7.3	6.6
Toshiba (190)	30%	8.1	7.2	6.7	6.8
Zenith Data Systems (52)	19%	7.3	6.6	5.8	3.6
ZEOS (209)	25%	8.1	7.2	6.5	4.2
Locally built (3,670)	30%	8.4	8.2	7.7	7.3
AVERAGE	31%	8.1	7.4	7.1	6.3

NOTEBOOK VENDORS

	Units needing repair over the past 12 months	Satisfaction with reliability	Satisfaction with repair	Satisfaction with tech support	Buy again?
Acer (74 responses)	26%	7.6	6.7	6.9	6.2
Apple (86)	33%	7.9	7.3	7.3	6.7
AST (91)	45%	7.2	5.9	6.1	5.3
Compaq (901)	34%	7.8	6.8	7.0	6.9
Dell (904)	31%	8.5	7.9	8.1	8.2
Digital (71)	21%	7.7	6.0	5.8	5.4
Fujitsu (99)	29%	7.6	6.2	6.3	6.8
Gateway (493)	31%	8.4	7.4	7.8	8.0
Hewlett-Packard (230)	26%	8.0	6.8	7.1	7.1
Hitachi (68)	28%	7.9	7.3	7.4	6.4
IBM (1,085)	28%	8.5	7.7	8.0	8.0
Micron (196)	36%	8.5	8.1	8.0	7.7
NEC (194)	32%	7.8	6.9	6.8	6.4
Sony (59)	19%	8.7	8.0	7.9	8.1
Texas Instruments (131)	31%	7.3	6.5	6.0	4.7
Toshiba (1,319)	29%	8.4	7.3	7.3	7.7
WinBook (164)	40%	8.0	6.8	7.1	7.2
AVERAGE	31%	8.0	7.4	7.1	6.9

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Vendor Grades Past and Present: Overall Use

This year, *PC Magazine* subscribers rated 20 desktop vendors and 17 notebook vendors. Sony makes a first-time appearance in the notebook category with an A, and we've introduced "locally built" into the desktop category; it earned a C.

DESKTOP VENDORS	7/99	7/98	7/97	7/96	7/95	1/95	7/94	1/94	7/93
Acer	E	D	D	C	C	B	C	D	D
Apple	B	C	B	B	B	B	B	B	C
AST	D	D	D	C	B	C	C	B	B
AT&T	C	D	C	C	D	B	E	E	E
Compaq	B	B	A	A	A	A	A	B	A
CompUSA	C	—	—	—	—	—	—	—	—
Dell	A	A	A	A	B	A	A	A	A
Digital	B	B	B	B	A	A	A	B	B
Gateway	C	B	B	B	B	A	A	A	A
Hewlett-Packard	B	A	B	A	A	A	A	A	B
IBM	A	A	A	A	A	A	A	B	B
Micron	B	B	B	B	B	A	A	B	—
MidWest Micro	D	B	C	D	B	C	—	—	—
NEC	C	C	C	B	B	C	C	D	B
Packard Bell	E	D	D	D	C	E	E	E	E
Quantex	A	B	C	—	—	—	—	—	—
Sony	B	B	—	—	—	—	—	—	—
Toshiba	C	C	B	—	—	—	—	—	—
Zenith Data Systems	C	D	D	D	D	E	E	E	E
ZEOS	C	C	B	C	C	A	A	A	A
Locally built	C	—	—	—	—	—	—	—	—

NOTEBOOK VENDORS

Acer	C	C	D	C	—	C	B	—	—
Apple	C	C	C	B	C	A	A	A	B
AST	E	D	D	D	D	D	D	D	B
Compaq	B	D	C	A	A	A	A	A	A
Dell	B	A	A	B	C	D	C	B	A
Digital	C	—	—	—	—	—	—	—	—
Fujitsu	C	—	—	—	—	—	—	—	—
Gateway	B	A	C	B	B	A	B	A	C
Hewlett-Packard	C	C	B	B	B	A	B	—	—
Hitachi	C	C	—	—	—	—	—	—	—
IBM	A	B	B	B	B	A	A	B	A
Micron	B	B	B	—	—	—	—	—	—
NEC	C	C	B	B	B	B	B	D	D
Sony	A	—	—	—	—	—	—	—	—
Texas Instruments	D	D	D	D	C	A	A	C	C
Toshiba	B	C	B	A	A	B	B	B	A
WinBook	D	D	C	C	—	—	—	—	—

A dash indicates that the vendor was not represented in our published survey results for that year.

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Repair/Support Scores: Desktops vs. Notebooks

	REPAIR EXPERIENCE (among those needing repairs)							TECH-SUPPORT EXPERIENCE (among those using technical support)				
	Time on hold (minutes)	Problem solved over the phone	Sent new part	Fixed on-site	PC was sent out for repair	Got a new PC	Got a new screen	Tech was knowledgeable	Tech tried every- thing to help	Prompt resolution	More than one call to resolve	
DESKTOP VENDORS—OVERALL USE												
Acer	12.7	25%	24%	18%	25%	4%	21%	27%	23%	20%	35%	
Apple	17.6	26%	20%	26%	26%	6%	14%	46%	46%	44%	34%	
AST	15.0	27%	21%	31%	32%	6%	24%	30%	30%	31%	39%	
AT&T	40.0	13%	22%	44%	22%	9%	25%	20%	35%	15%	20%	
Compaq	13.4	22%	24%	35%	22%	6%	17%	35%	29%	28%	36%	
CompUSA	12.9	33%	22%	17%	39%	6%	42%	47%	37%	21%	37%	
Dell	9.1	36%	37%	32%	6%	3%	6%	53%	45%	53%	22%	
Digital	11.6	18%	24%	38%	27%	8%	16%	34%	31%	34%	34%	
Gateway	12.1	45%	51%	13%	9%	2%	10%	53%	47%	44%	29%	
Hewlett-Packard	13.0	31%	22%	29%	22%	5%	13%	42%	34%	38%	30%	
IBM	9.5	21%	27%	32%	24%	4%	12%	41%	38%	39%	24%	
Micron	12.0	36%	53%	13%	11%	3%	7%	57%	46%	51%	25%	
MidWest Micro	17.8	32%	43%	4%	7%	4%	17%	48%	22%	30%	44%	
NEC	8.7	27%	17%	33%	30%	5%	22%	41%	35%	37%	29%	
Packard Bell	21.7	30%	9%	18%	29%	3%	24%	30%	30%	23%	48%	
Quantex	12.4	42%	49%	9%	9%	N/A	2%	62%	51%	57%	18%	
Sony	14.3	47%	32%	16%	11%	11%	17%	41%	35%	38%	38%	
Toshiba	14.6	18%	16%	23%	42%	7%	30%	38%	25%	25%	37%	
Zenith Data Systems	7.3	10%	30%	30%	30%	10%	N/A	30%	40%	30%	40%	
ZEOS	11.4	28%	26%	9%	32%	4%	18%	57%	41%	29%	35%	
Locally built	10.3	19%	23%	21%	26%	2%	7%	40%	36%	40%	27%	
AVERAGE	14.2	28%	28%	23%	23%	5%	16%	41%	36%	35%	32%	
NOTEBOOK VENDORS												
Acer	14.4	11%	26%	5%	42%	21%	19%	43%	38%	52%	24%	
Apple	17.1	18%	36%	11%	54%	7%	18%	27%	5%	32%	32%	
AST	15.4	17%	17%	12%	61%	5%	23%	23%	17%	23%	47%	
Compaq	13.3	19%	28%	18%	42%	8%	17%	44%	30%	33%	34%	
Dell	9.7	27%	36%	20%	31%	7%	13%	55%	38%	44%	27%	
Digital	14.4	27%	27%	7%	53%	13%	32%	26%	26%	21%	47%	
Fujitsu	20.9	21%	28%	3%	55%	3%	36%	39%	32%	26%	52%	
Gateway	10.7	32%	37%	5%	29%	10%	8%	56%	46%	46%	29%	
Hewlett-Packard	12.6	21%	24%	15%	50%	15%	13%	42%	40%	36%	29%	
Hitachi	14.9	21%	26%	N/A	47%	5%	19%	57%	38%	24%	38%	
IBM	11.8	25%	30%	15%	40%	6%	7%	52%	37%	45%	21%	
Micron	13.1	30%	43%	3%	36%	7%	7%	49%	40%	48%	24%	
NEC	11.0	18%	18%	5%	63%	5%	14%	39%	31%	33%	35%	
Sony	9.1	36%	55%	N/A	27%	18%	20%	45%	45%	35%	25%	
Texas Instruments	10.8	17%	15%	10%	61%	2%	25%	25%	29%	18%	39%	
Toshiba	12.5	16%	19%	13%	58%	5%	19%	39%	34%	32%	32%	
WinBook	9.4	17%	17%	5%	52%	6%	11%	45%	38%	36%	20%	
AVERAGE	13.0	22%	28%	9%	47%	8%	18%	42%	33%	34%	33%	

N/A—Not applicable: There were no responses for this question.

IBM tops our list of desktop vendors with its seventh A in a row: a record for this survey. Its scores on specific questions concerning repairs and technical support are almost all better than average, and its recent-repair score is among the best. IBM also tops the notebook charts, with above-average scores and an excellent buy-again score.

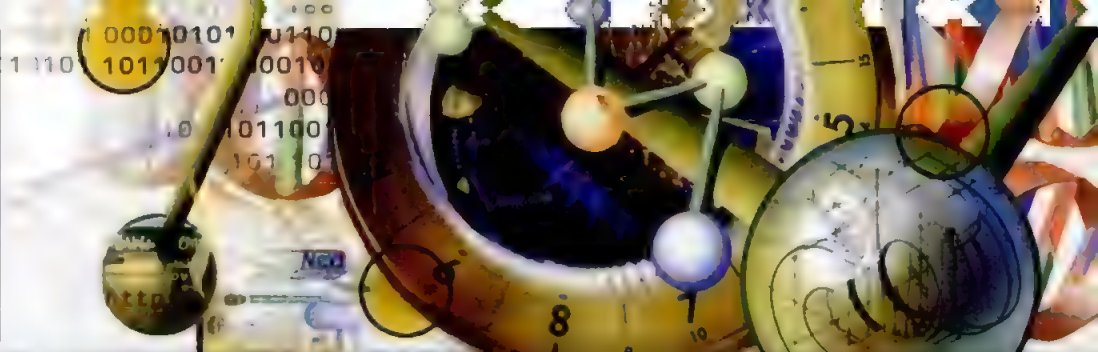
Micron earns B's across the board and a high buy-again score. Only on one of our four key measures is it consistently average rather than better than average: repair frequency during the past 12 months. This keeps Micron out of A territory for both desktops and notebooks.

Our respondent pool for **MidWest Micro** is large enough only for an overall desktop grade (which turns out to be D). More than the average number of users say they needed multiple calls to resolve problems, and the company has the lowest score among all desktop vendors for the number of repairs fixed on-site (4 percent). As it did last year, MidWest Micro also posts the worst score in the survey for repair frequency, this time 46 percent (last year's score was 45 percent).

NEC's scores make for a curious contrast with those of Packard Bell. The vendors share the same parent company as well as many manufacturing and support facilities, yet NEC's scores are average across the board (for a grade of C), while Packard Bell's are consistently poor. In addition, some of NEC's technical-support scores are much better than Packard Bell's. In fact, NEC's average of 7 minutes on hold is the best among office desktops (the average is 15 minutes).

Packard Bell scores worse than average on all four key measures in the home desktop category (hence the E grade) as well as on the buy-again question. Callers for technical support typically spent 19 minutes on hold, as compared with a home PC average of 13 minutes (NEC's score was 10 minutes). And when our readers did reach someone, 49 percent say they needed more than one call to resolve problems (the average is 31 percent).

Quantex is the fourth-largest direct vendor in the U.S. and earns a B for home PCs and an A overall. (It doesn't receive enough office PC responses for inclusion in that category.) Its technical-support



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How We Surveyed

In January, we mailed 17,000 questionnaires to a randomly selected sample of *PC Magazine* subscribers. The survey was closed for tabulation on March 30, when we had achieved a response rate of 50 percent (a standard level of statistical weight). Audits & Surveys Worldwide, an international market research firm with offices in San Francisco and New York, managed the study and tabulated the data. The survey covered desktop PCs, notebooks, printers, software applications, and Internet service providers. The printer, software, and ISP results appear later in this issue.

Each subscriber was asked to rate up to three desktop PCs, three notebook PCs, and three printers used in the past two years. Subscribers were asked to rate their satisfaction, using a scale from 1 ("not at all satisfied") to 10 ("very satisfied"), for overall reliability, repair experience, and technical support. They also indicated the number of times their PCs needed to be repaired in the past 12 months. Respondents likewise indicated which software applications they had installed and used most often in each of five categories. They rated their overall satisfaction, their satisfaction with technical support, and their satisfaction with a number of specific types of technical support.

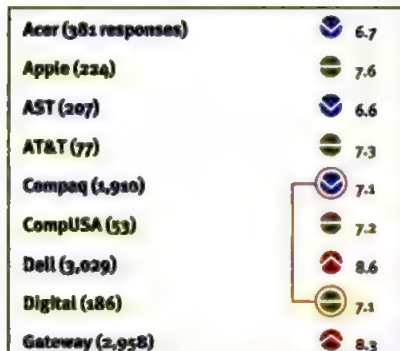
Only those vendors for which we received 50 or more responses—the minimum number necessary to produce statistically reliable results—were included in the final tabulations. On each survey question, the individual readers' ratings for each manufacturer are averaged to make a score for that vendor. Each manufacturer's score is then compared with the others using a statistical test known as a *t*-test.

T-tests are statistical procedures used to compare

differences between means. In this case, we measure each manufacturer's score on each measure against the *overall average* for all manufacturers and determine whether the scores are significantly different from the average at a 95 percent confidence level. T-tests take into account several variables, including—in this case—the number of responses each manufacturer generated, the amount of *variation*

among those ratings (the spread of the data from the mean), and the ratings themselves. These components determine the *confidence interval* for each score, or the range within which we are 95 percent certain that the score is relevant. In cases where this range lies entirely above or below the overall average, we can say that the score is *significantly different* from the overall average.

This leads us to an important point: When looking at the difference between two groups of responses—say, repair satisfaction ratings for vendor X and vendor Y—we can judge the difference between their means only by keeping in mind the spread, or variability, of the individual ratings. Two vendors may have identical numerical scores (which are the averages of all the ratings each vendor received from readers on a particular measure), but what determines whether those scores are significantly different from the overall average is their ranges, or the variability of the individual ratings that make up those scores.



As the graphic shows, though two vendors may receive the same numerical score, when tested against the average, one may emerge as significantly better or worse than average while the other does not.

scores are first-class: Just 2 percent say they got a runaround (the home average is 17 percent), and scores for technical-support helpfulness are in the 50 to 60 percent range, significantly better than the average.

Sony's notebook business has started to take off, this year gaining enough market share to make our study. It earns an A, with above-average scores on all four of our key measures, including an especially high reliability score and the lowest repair frequency in the survey (19 percent). Sony's desktops earn a B overall, but most respondents are home users, who give Sony a C. The pool of desktop office users is not large enough for reli-

able reporting on that category.

Toshiba moves up to a B for its notebooks and retains a C for desktops, including its growing office PC business and its now-defunct home PC business. Toshiba's notebooks, which earn a B, get particularly high reliability and repair scores.

WinBook holds steady with a D this year, thanks to a worse-than-average score for units needing repair. On all other measures WinBook is average. The good news: The average time on hold is a very low 9.4 minutes (the average is 13).

When we included locally built PCs in the survey, we hypothesized that VARs (value-added resellers) and local assem-

blers would do a good job of hand-holding their customers. And that is exactly the case: The three satisfaction scores are all above average. But the recent repair scores are worse than average—particularly for home users—leading to C's for both office and home PCs. Naturally, this is a desktop-only category; there are no locally built notebooks unless you happen to live in Silicon Valley or Taiwan.

Be sure to check our charts for more detailed data. Note that summaries of these scores will appear in our comparative reviews of PCs and notebooks throughout the next year to assist you with your buying decisions. 

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PC Reliability &
Service Survey
PC World
November 1998



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* *PC Reliability & Service Survey, PC World, Nov. 1998*

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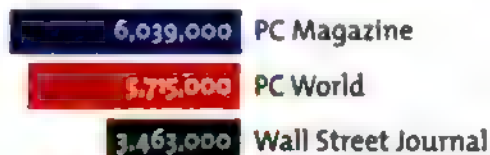


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Printers

SERVICE & RELIABILITY

WHEN IT COMES TO REPAIRS AND SUPPORT, SOME PRINTER VENDORS ARE MORE EQUAL THAN OTHERS.

By Bill Howard, Josh Levy, and Monique Mehta

MANY PRINTERS ARE RELATIVELY SIMPLE contraptions, with few problems that can't be fixed by popping in a new ink cartridge. Only heavy-duty network lasers present significant support issues, which arise most notably from the wear and tear of printing several thousand pages a week and from the network connections themselves. But no matter where you've bought your printer, no matter how you use it or what type of printer it is, the odds are you'll need some help resolving a problem at some point. Before you buy, consider these basic questions: Is the printer reliable? Does the company have a dependable and knowledgeable support staff? Are current customers happy enough that they'd be willing to buy from the same vendor again?

This is the eighth *PC Magazine* survey of printer service and reliability. To gauge how well vendors are serving customers, we asked subscribers to rate the printers they've used during the past two years. We asked them to judge each unit based on how many times in the past 12 months it has needed repair, as well as on their overall satisfaction with reliability, repair experience, and technical support. The Readers' Report Card, which assigns a grade to each vendor, is based on these four measures. We also asked readers to indicate the likelihood of their buying a printer again from the same vendor.

New for this year, we've taken a closer look at color laser-class printers. High-speed networked printers, especially those with color capability, are the most difficult to maintain. They tend to require the most support calls and

visits from vendor technicians, which inevitably leads to lower satisfaction scores on surveys like this one. Still, it's possible to differentiate between vendors within a category, and for that purpose, we're providing separate scores for the networked color laser class.

Looking at the numbers overall, we saw some interesting, if not always positive, new trends. One consequence of today's lower printer prices may be manufacturers having less money to allocate to technical support. According to our survey, time spent on hold waiting for printer support has jumped by a third, from 9.1 minutes last year to 12.3 minutes this year.

EPSON AND HP: STILL ON TOP

When it comes to printer service and reliability, it's another banner year for Epson and Hewlett-Packard, still the only two vendors to earn A's in this survey. To merit an A, a vendor has to receive better-than-average scores on all four key measures; since 1995, both Epson and HP have swept the field. Their percentage of units needing repair over the previous 12 months remains better than average: 14 percent for Epson and 16 percent for HP, versus an average of 21 percent. Both post outstanding scores for readers' likelihood of buying again from the same manufacturer. Epson and HP also perform similarly and receive better-than-average scores for technical-support experiences.

One noteworthy vendor has pulled itself out from under a several-year run of disappointing grades. Last year, Xerox received a D after two years of C's; its 1998 score for units

Report Card

PRINTER VENDORS

A Epson
Hewlett-Packard

B Alps
Apple
Citizen
IBM
Lexmark
NEC
Panasonic
Star Micronics
Xerox

C Okidata

D Brother
Canon
Digital
QMS
Tektronix
Texas Instruments

Our Contributors: BILL HOWARD is the senior executive editor of *PC Magazine*, and JOSH LEVY is a staff editor. MONIQUE MEHTA is the research manager at *PC Magazine*, and JENNIFER TRIVERIO was the associate editor in charge of this story.



needing repair within the past 12 months was below average, and all its satisfaction scores were average. This year, the company jumps to a B, with average scores on most key measures and a better-than-average score for satisfaction with technical support. Xerox attributes this positive movement to its revamped technical-support team. Since migrating its corporate focus from copiers to printers, the company has made a concerted effort to hire a more technically adept support staff, and this may be finally paying off with a higher level of satisfaction among customers.

At the other end of the spectrum, a relatively large number of vendors post D's this year (a mix of average and worse-than-average scores), including Canon, one of the most significant players in the printer market. No vendors receive an E (meaning that all scores are worse than average).

Canon has typically made a good showing in our surveys, posting A's and B's in past years. This time around, it drops to a D, receiving below-average

Printers:

- Epson, Hewlett-Packard

In a repeat of last year's results, Epson and Hewlett-Packard top the list of printer vendors on our Service and Reliability Survey. Both companies receive above-average scores on all four of our key measures: satisfaction with reliability, satisfaction with repair experience, satisfaction with technical support, and the number of units that have needed to be repaired in the past 12 months (repair frequency). This is the fifth year in a row that Epson and HP take top honors.

Not surprisingly, both companies receive strong votes of confidence on the question of buying again from the same vendor. 69 percent of our respondents who own an Epson printer say they would be "extremely likely" to pur-

chase another; 83.6 percent of our survey's Hewlett-Packard customers say the same for that company's printers. HP also earns an excellent, better-than-average score for telephone time spent on hold. (Epson's only average score is posted on this measure.)

Also of note, Xerox emerges as the most improved vendor, rising from last year's D to a solid B in this year's survey (thanks in part to a change in the management and staffing of its technical-support division). Xerox now joins the ranks of other B vendors: Alps, Apple, Citizen, IBM, Lexmark, NEC, Panasonic, and Star Micronics. All these vendors make a better-than-average showing on some but not all key measures in our survey.

Vendor Grades Past and Present

	1999	1998	1997	1996	1995
Alps	B	—	—	D	D
Apple	B	C	B	B	B
Brother	D	C	D	D	C
Canon	D	B	B	B	A
Citizen	B	C	D	C	C
Digital	D	C	C	C	B
Epson	A	A	A	A	A
Hewlett-Packard	A	A	A	A	A
IBM	B	B	B	—	—
Lexmark	B	B	B	B	B
NEC	B	B	B	D	C
Okidata	C	C	C	D	B
Panasonic	B	B	B	B	B
QMS	D	D	D	D	C
Star Micronics	B	B	B	B	B
Tektronix	D	D	C	D	D
Texas Instruments	D	E	D	D	C
Xerox	B	D	C	C	—

A dash indicates that the vendor was not represented in our published survey results for that year.

scores on all satisfaction measures and an average score for the number of units needing repair within the past 12 months. According to Canon representatives, however, a full 64 percent of printers that need repair are back in service in less than five days. The vendor also claims a response time of less than 45 seconds for new users who call technical support with installation questions. It's worth noting that in our study, Canon ranks above average for readers' likelihood of buying again from the same vendor. Our survey also shows that the time Canon users spend on hold waiting for technical support—11.3 minutes—is in the average range for this group.

NETWORKED COLOR LASERS

Historically, high-end color printers have had a reputation for being expensive and finicky. Manufacturers say the machines have improved but that they still should be compared with each other, independently of printers in general. This year, we highlight laser-class printers for additional tabulation, to judge these admittedly support-heavy units on their own terms. (Keep in mind that these printers are also included in the overall pool of printers

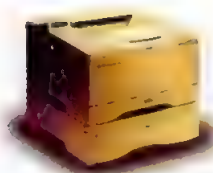
from which general scores and vendor grades are drawn.)

By *color laser-class* we mean not only true color lasers but also the solid-ink printers commonly used for glossy color output in offices and graphic design shops. (We don't mean the older thermal-wax transfer or dye-sublimation printers.) A half-dozen vendors sell these units, but HP and Tektronix dominate. In fact, no other vendors have achieved enough responses for this class of printer to allow us to make a judgment on their merit.

Our findings: Hewlett-Packard scores higher than Tektronix by a significant margin. HP's color laser scores are a bit worse than the company's overall printer scores (which also include ink jet and monochrome laser printers). Tektronix's color laser scores are actually better than its overall scores because of the large number of older-technology Tektronix printers still in use.

The numbers paint a clear picture: Readers seem generally satisfied with both HP and Tektronix. But those who use HP color laser-class printers are more likely to rate their vendor in the 7-to-10 range (on the survey's 10-point

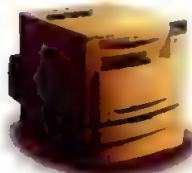
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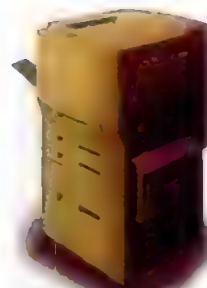
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Printer Vendor Scores

	Significantly better than average	Average	Significantly worse than average	Units needing repair over the past 12 months	Satisfaction with reliability	Satisfaction with repair	Satisfaction with tech support	Buy again?	Minutes on hold			
Alps (63 responses)		10%		8.1		7.3		7.6		7.6		
Apple (130)		21%		8.6		7.3		7.4		6.7		14.6
Brother (240)		22%		8.2		6.9		6.3		7.1		14.9
Canon (1,505)		19%		8.0		6.8		6.9		7.3		11.3
Citizen (62)		10%		7.9		6.9		6.1		4.8		6.3
Digital (58)		29%		7.4		6.9		7.5		5.0		15.1
Epson (2,426)		14%		8.5		7.5		7.8		8.2		15.5
Hewlett-Packard (10,016)		16%		9.1		8.3		8.3		9.2		10.1
IBM (229)		22%		8.7		7.9		7.9		6.9		6.6
Lexmark (779)		21%		8.3		7.6		7.7		7.5		8.5
NEC (204)		18%		8.6		6.8		7.1		7.4		18.6
Okidata (422)		24%		8.3		7.2		7.2		7.1		25.8
Panasonic (548)		12%		8.4		7.3		7.2		6.7		13.2
QMS (92)		36%		7.8		6.3		6.5		5.5		7.6
Star Micronics (60)		7%		8.2		7.2		7.1		5.1		7.0
Tektronix (204)		45%		8.0		7.1		7.3		7.1		9.7
Texas Instruments (64)		30%		7.8		6.4		5.5		4.8		12.5
Xerox (119)		29%		8.2		7.4		7.9		7.4		16.3
AVERAGE		21%		8.2		7.2		7.2		6.7		12.3

scale) than Tektronix respondents are. Tektronix users are also more than twice as likely to have had a repair experience within the past 12 months. Finally, HP users are almost twice as likely to buy again from the same vendor as Tektronix users are.

STEADY PROGRESS

For the rest of the market, the scores are slowly getting better, though the grades—based on group averages—are in many cases holding steady.

A grade of B, which represents a combination of better-than-average and average scores on the four key measures, goes to nine vendors: Alps, Apple, Citizen, IBM, Lexmark, NEC, Panasonic, Star Micronics, and Xerox.

IBM, which also earned a B last year, gets an average score this time for units needing repair, but a better-than-average score on all satisfaction measures. Our readers give it an average score for likelihood to buy again. Notably, IBM's time-

on-hold score is among the very best.

Lexmark, whose market share in the consumer space continues to increase, posts average scores on units needing repair during the past 12 months and on satisfaction with overall reliability. It earns a B grade because of better-than-average scores for satisfaction with repair and technical support. Lexmark also posts better-than-average scores for time-on-hold and for customer willingness to buy again from the same vendor.

To earn a C, a manufacturer must post either average scores on all key measures or a combination of above-average and below-average scores. This year, only one vendor, Okidata, falls into this category, receiving average scores on all four key measures that make up the grade. Okidata earns an above-average score, however, for likelihood of buying from the vendor again. These scores mark an improvement for Okidata since last year, when it received a D grade and a merely average score for readers' willingness to

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buy again from the same company.

Both Brother and Digital drop from a C to a D this year. A D indicates a mix of average and worse-than-average scores. Brother gets a D thanks to its worse-than-average score on satisfaction with technical support; all other scores on key measures were average. Unlike last year, Brother now receives an above-average buy-again score (last year it was only average).

Digital receives a D this year for its worse-than-average score on satisfaction with reliability. Users also give Digital a below-average score on willingness to buy again from the same vendor. It's worth noting, however, that Digital has been purchased by Compaq. It's possible that its service and support scores will change in future surveys because of staffing and management restructuring and new products being manufactured in different facilities.

Much the same as last year, those vendors whose main business is high-end laser-class printers continue to score poorly overall when compared head to head with other companies. QMS and Tektronix, two significant players in this market, both receive D's. QMS's grade is accounted for by its worse-than-average score for repair frequency in the last 12 months—probably a direct result of the complexity of installing and maintaining its heavy-duty networked printers. Our readers also give QMS a below-average score for likelihood to buy again. Tektronix receives only one below-average score, and as with QMS, it's for recent repair frequency. On all other key measures, Tektronix receives average scores for the group, and its buy-again score is above average at 7.1 (the average is 6.7).

STILL WITH MEP

At the end of the day, one of the best measures of how customers feel about a manufacturer is whether they would consider buying products from the same vendor again. This year, Hewlett-Packard once again sails past the competition with a score of 9.2 out of a possible 10. Epson, the other A recipient, takes a solid second place, with an 8.2 score. Five vendors receive below-average likelihood-to-buy-again scores: Citizen, Digital, QMS, Star Micronics, and Texas Instruments. **PC**

1. Start image editing software
2. Choose "file acquire"
3. Pre-scan page
4. Set scan area
5. Set resolution
6. Set scan mode
7. Scan page
8. Close TWAIN
9. Save file
10. Close image editing application
11. Start e-mail package
12. Start new message
13. Choose "attach file"
14. Locate saved file on hard disk

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Software

SUPPORT & SATISFACTION

THE RESULTS ARE IN. FIND OUT HOW YOUR FAVORITE APPS STACK UP TO THE COMPETITION FOR USER SATISFACTION AND SUPPORT.

By Monique Mehta

WHEN IT COMES TO THE SOFTWARE they use day in and day out, *PC Magazine* subscribers have a love/hate relationship. They love the power provided by the latest applications, but they hate the complexity that comes with it. Subscribers are quick to embrace the new office suite or download the browser of the month, and they give their software relatively high scores overall. But too many say they often need technical support, and when they turn to it, they usually find it to be subpar.

Of the approximately 7,000 readers who have answered our annual software survey this year, the majority rate their applications at 7 or higher (on a scale of 1 to 10) for overall satisfaction. Similarly, the majority of respondents say that they would be likely to recommend a product to another user. Either our respondents are grading on a curve or they are generally pretty satisfied with their software.

At the same time, the average scores in the technical-support section of our survey are consistently worse. For example, about 20 to 25 percent of those surveyed say they have needed technical support in the past 12 months. The most troublesome packages are operating systems and corporate messaging products such as Lotus Notes and Microsoft Exchange. Not coincidentally, these are also the two categories where the average scores for overall satisfaction are slightly lower.

Although readers seem satisfied with vendors' efforts to provide better support via the Web, there is no substitute for printed documentation and tutorials—two areas where scores are generally mediocre. The most glaring example is Microsoft: In four of the five cate-

gories, the leading Microsoft products are rated worse than average for printed documentation.

A closer look at the scores for individual products reveals more interesting trends. As mentioned above, the most widely used products are often not the ones that are delivering the highest level of satisfaction.

This is the case in most categories, including operating systems, application suites, Web browsers, and Internet e-mail. In all of these categories, Microsoft has the dominant products. In itself, this is telling confirmation of Microsoft's success at dominating the desktop market. But what's more interesting is that in all of these categories, Microsoft receives either average or worse-than-average scores for overall satisfaction. (The significant exception is Microsoft Exchange, the only Microsoft product that gets consistently strong scores across the board.)

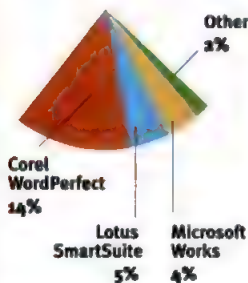
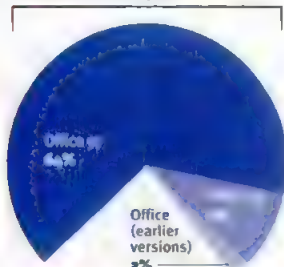
The picture changes, however, when we ask readers whether they would recommend a product to others. In two categories, operating systems and applications suites, in many cases the same Microsoft products notch better-than-average scores. In part, subscribers may feel more comfortable recommending market leaders. But there could be other, related factors as well. In the case of operating systems, Microsoft Windows 98's support for a wide range of software and hardware may be decisive. And in the case of Microsoft Office 97, file compatibility has become a driving issue because of the number of legacy files out there.

Many factors go into a successful piece of software, and market share alone is no indicator of user satisfaction. To succeed long-term, vendors still must produce innovative, easy-to-use

The Top Office Suites

Our survey confirms Microsoft's domination of the suites market.

Microsoft Office 75%



Source: PC Magazine's Software Support and Satisfaction Survey.

Our Contributors: MONIQUE MEHTA is the research manager at *PC Magazine*. DIANE JECKER was the project leader, and JOHN MORRIS was the associate editor in charge of this story.

Software Scores: Overall Satisfaction

- Significantly better than average
- Average
- Significantly worse than average

OPERATING SYSTEMS

	Overall satisfaction	Likelihood to recommend
MS-DOS	8.3	8.0
MS Windows 98	7.8	8.0
MS Windows 95	7.4	7.3
MS Windows NT 4.0	8.0	7.9
MS Windows 3.x	7.2	5.4
Unix	9.1	8.7
AVERAGE	8.0	7.6

APPLICATION SUITES

	Overall satisfaction	Likelihood to recommend
Corel WordPerfect Suite 8	8.6	8.7
Corel WordPerfect Suite 7	8.4	8.3
Corel WordPerfect (earlier versions)	8.5	8.0
Lotus SmartSuite Millennium Edition	8.4	8.0
Lotus SmartSuite 97	8.2	7.9
Lotus SmartSuite (earlier versions)	7.9	7.2
MS Office 97	8.3	8.4
MS Office 95	8.1	7.9
MS Office (earlier versions)	7.9	7.3
MS Works Suite 99	8.6	8.3
MS Works (earlier versions)	8.1	7.6
AVERAGE	8.3	8.0

WEB BROWSERS

	Overall satisfaction	Likelihood to recommend
MS Internet Explorer 4.x or 5.0	8.2	8.0
MS Internet Explorer 3.0 or earlier	7.6	7.1
Netscape Navigator 4.x	8.6	8.7
Netscape Navigator 3.0 or earlier	8.3	8.0
AVERAGE	8.2	8.0

INTERNET E-MAIL

	Overall satisfaction	Likelihood to recommend
AOL Mail	7.9	7.6
Eudora Pro Email	8.4	8.3
MS Outlook	8.0	7.8
MS Outlook Express	8.2	8.0
Netscape Messenger/Netscape Mail	8.3	8.1
Pegasus Mail	8.4	8.1
AVERAGE	8.2	8.0

CORPORATE MESSAGING

	Overall satisfaction	Likelihood to recommend
cc:Mail	6.8	5.5
GroupWise	7.1	6.3
Lotus Notes	7.3	6.7
MS Exchange	7.7	7.2
AVERAGE	7.2	6.4

applications, backed with comprehensive support options, documentation, and built-in program help and tutorials. In this survey, we look at 21 different packages in five major categories to determine who's delivering in these key areas.

OPERATING SYSTEMS

Most *PC Magazine* readers use Microsoft Windows operating systems. But what is surprising is the extent to which Windows has eclipsed the alternatives. For the first time, this year Apple's Mac OS and IBM OS/2 Warp fail to garner enough responses to be reported here (the cutoff is 50 responses). Meanwhile, Unix barely makes the cut, with slightly less than 1 percent of the 7,748 responses to this section.

Overall, 97 percent use a Microsoft operating system—primarily Windows 95 and Windows 98. Among those who use an operating system both at home and at work, Windows 95 still has the edge over its successor, Windows 98: 53 percent say

they use Windows 95, and 32 percent say they use Windows 98 in both places. Yet Windows 98 is more popular at home: 51 percent of those who use an operating system only at home say they use Windows 98. At work, Windows NT 4.0 has the edge, with 48 percent, followed by Windows 95 (28 percent) and Windows 98 (just 14 percent). Most likely, many companies have decided to sit out Windows 98, which contains mostly minor enhancements, in

favor of the forthcoming Windows 2000.

The majority of readers use Windows 95 and Windows 98, but that doesn't mean they are completely happy about it; in fact, both products receive worse-than-average scores for overall satisfaction. Windows NT gets an average score, while a small contingent of Unix mavens propel it to a better-than-average score. The picture changes when we ask readers whether they would recommend their OSs to others. Here the latest OSs (Windows 98 and NT 4.0) fare best.

Microsoft gets mixed results for its OS support. Windows 98 debuts with an average overall score; Windows 95 and Windows NT 4.0 do not budge from last year's results of worse than average and average, respectively. Although Windows 98 users complain about the printed documentation—or lack thereof—they give Microsoft better-than-average scores for tutorials and support via the Web. Windows 98 includes a new HTML-based help system, integration with online help at Microsoft's Personal Support Center, and a Windows Update feature for downloading and installing patches and enhancements.

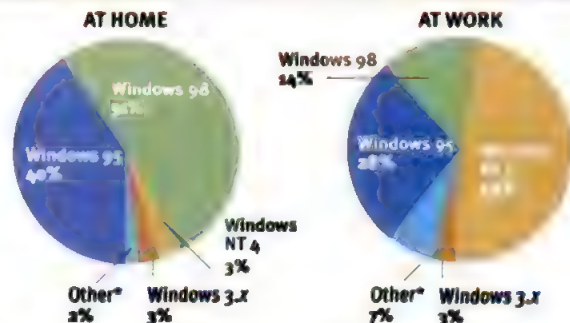
OFFICE SUITES

It's no secret that Microsoft Office practically owns the office suites market. In this year's survey, more than 75 percent of readers say they use a version of Microsoft Office, and another 4 percent use that other Microsoft suite, Works. Nevertheless, Corel WordPerfect Suite and Lotus SmartSuite hang onto respectable slices of the market, with 14 and 5 percent, respectively.

Most readers say they use the latest versions of their office suites. More than 64 percent of all respondents are using MS Office 97, and since its introduction in June 1997 Corel WordPerfect Suite 8 has

Operating-System Usage At Home and At Work

Many subscribers use computers both at home and at work. But those who use them only one place or the other use different operating systems, as shown here.



* Includes Linux, Mac OS, Microsoft Windows NT 3.51 or earlier, MS-DOS/OS/2 Warp, Unix, and others.

Source: *PC Magazine's* Software Support and Satisfaction Survey.



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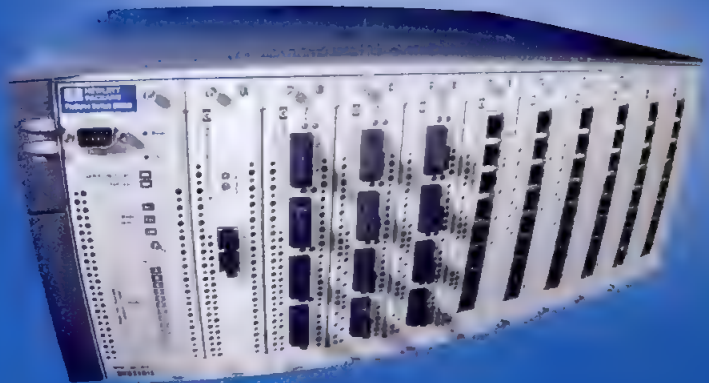
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Software Scores: Technical Support

- Significantly better than average
- Average
- Significantly worse than average

OPERATING SYSTEMS

	Overall technical support	Percent needing support in the past 12 months	Printed documentation	Tutorials	Support via the Web	Hardware vendor support	Built-in program help	Telephone technical support
MS-DOS	7.1	8%	7.3	4.4	6.6	5.0	6.2	6.3
MS Windows 98	6.7	34%	5.6	6.1	6.8	6.8	6.5	6.0
MS Windows 95	6.2	30%	5.4	5.8	6.5	6.5	6.1	5.6
MS Windows NT 4.0	6.6	39%	5.5	5.4	6.8	6.7	6.0	5.7
MS Windows 3.x	5.7	10%	5.9	5.7	5.9	6.4	5.7	5.0
Unix	7.7	43%	7.2	7.3	7.8	7.0	7.7	8.1
AVERAGE	6.7	27%	6.2	5.8	6.8	6.4	6.4	6.1

APPLICATION SUITES

	Overall technical support	Percent needing support in the past 12 months	Printed documentation	Tutorials	Support via the Web	Hardware vendor support	Built-in program help	Telephone technical support
Corel WordPerfect Suite 8	7.7	32%	6.9	7.1	7.5	6.8	7.4	7.4
Corel WordPerfect Suite 7	7.5	17%	6.8	7.3	7.1	7.2	7.3	7.7
Corel WordPerfect (earlier versions)	7.7	16%	7.6	7.0	6.9	6.2	7.2	7.5
Lotus SmartSuite Millennium Edition	7.4	25%	7.3	7.2	7.3	6.5	7.3	7.3
Lotus SmartSuite 97	7.4	13%	7.1	7.1	7.5	7.6	7.4	7.1
Lotus SmartSuite (earlier versions)	8.0	14%	7.1	8.0	7.8	7.6	7.2	7.0
MS Office 97	6.7	29%	5.9	6.3	7.1	6.6	6.9	6.0
MS Office 95	6.7	17%	6.0	6.3	6.7	6.5	6.7	6.3
MS Office (earlier versions)	6.9	17%	6.1	6.5	6.8	6.3	6.5	5.9
MS Works Suite 99	8.6	16%	7.8	7.6	7.5	7.0	7.2	8.4
MS Works (earlier versions)	7.4	8%	6.6	7.2	7.3	6.4	7.2	6.5
AVERAGE	7.5	19%	6.8	7.1	7.2	6.8	7.1	7.0

WEB BROWSERS

	Overall technical support	Percent needing support in the past 12 months	Printed documentation	Tutorials	Support via the Web	Hardware vendor support	Built-in program help	Telephone technical support
MS Internet Explorer 4.x or 5.0	7.0	20%	5.6	5.9	7.1	6.7	6.6	6.1
MS Internet Explorer 3.0 or earlier	6.8	20%	5.5	5.8	6.1	6.4	6.0	6.1
Netscape Navigator 4.x	7.5	19%	6.3	6.3	7.3	6.6	6.7	7.1
Netscape Navigator 3.0 or earlier	7.2	16%	6.0	6.1	7.0	6.7	6.2	6.8
AVERAGE	7.1	19%	5.9	6.0	6.9	6.6	6.4	6.5

INTERNET E-MAIL

	Overall technical support	Percent needing support in the past 12 months	Printed documentation	Tutorials	Support via the Web	Hardware vendor support	Built-in program help	Telephone technical support
AOL Mail	7.4	25%	6.2	6.5	6.9	8.8	6.7	6.9
Eudora Pro Email	7.5	17%	6.7	6.0	6.9	6.3	6.5	6.8
MS Outlook	7.1	24%	5.4	5.8	6.9	6.3	6.4	6.0
MS Outlook Express	7.0	16%	5.5	5.9	6.8	7.4	6.5	6.3
Netscape Messenger/Netscape Mail	7.5	15%	6.0	6.1	7.0	6.4	6.5	7.1
Pegasus Mail	7.3	16%	7.0	6.9	7.8	5.5	7.1	4.5
AVERAGE	7.3	19%	6.1	6.2	7.1	6.4	6.6	6.3

CORPORATE MESSAGING

	Overall technical support	Percent needing support in the past 12 months	Printed documentation	Tutorials	Support via the Web	Hardware vendor support	Built-in program help	Telephone technical support
cc:Mail	6.1	19%	5.6	5.9	5.7	6.0	5.7	5.9
GroupWise	6.8	29%	5.5	5.2	6.6	5.9	5.6	6.4
Lotus Notes	6.8	26%	5.7	5.7	6.3	6.0	6.0	6.7
MS Exchange	6.7	21%	5.4	5.6	6.5	6.4	6.1	6.0
AVERAGE	6.6	24%	5.6	5.6	6.3	6.1	5.9	6.3

captured 9 percent of our respondents. One exception to the pattern: Slightly more readers use SmartSuite 97 than the more recent Millennium Edition, which has been shipping since June 1998. Microsoft Office 2000 and Corel WordPerfect Office 2000 did not ship in time to be included in our survey (see "Office 2000: Should You Upgrade?", May 25, 1999, for reviews).

The two standouts in this category are the ones used most. Corel WordPerfect Suite 8 is the only product to earn a better-than-average score for overall satisfaction, but users of both Corel and Microsoft Office 97 say they would recommend the packages to others. All other products receive average or worse-than-average scores on these two measures.

MS Office 97 deserves its success: It offers the most features, best usability, and tightest integration of the big three office suites. But one area where it could still use some help is in support—at least according to *PC Magazine* readers. MS Office 97 receives worse-than-average scores on all but one of the eight technical-support questions, the exception being the support provided through the hardware vendor.

The only product that receives a better-than-average score for overall technical support is Microsoft Works Suite 99; all other products get average scores. Although nearly a third of the Corel WordPerfect Suite 8 users needed technical support in the last year, the package does well in other support areas such as built-in program help or support via telephone and the Web.

WEB BROWSERS

The battle of the browsers has faded into the background as Microsoft has steadily chipped away at Netscape's market share. While Netscape Navigator retains a respectable share of the market, Internet Explorer has taken a decisive lead: 55 percent of subscribers say they browse the Web with a version of IE. Last year, IE had 46 percent and Navigator 49 percent. (A small percentage use other browsers such as Opera.) By now, most subscribers have upgraded to the latest versions of their browsers; fewer than 10 percent of the respondents use older versions of IE or Navigator (3.0 or earlier).

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Summary

1

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Just because IE is winning the numbers game, however, doesn't mean that it is winning the hearts of *PC Magazine* readers. In fact, Navigator 4.x is the only browser that receives better-than-average scores for overall satisfaction and the likelihood of being recommended to others. IE 4.x and 5.0 are average in both respects, while the scores for older versions of both browsers are unexceptional.

Navigator 4.x is also the only product to notch a better-than-average score for overall technical support, and it does quite well across the board on support. By contrast, the scores for IE run the gamut from worse than average (printed documentation and telephone support) to better than average (Web support).

INTERNET E-MAIL

Unlike most major software categories, Internet e-mail remains a market with a large contingent of strong competitors. Although America Online commands a big audience (15 percent of our respondents), many readers say they are using one of the standard POP3 e-mail clients

instead. The most popular is Microsoft Outlook (23 percent), the hybrid e-mail client/PIM that is included with MS Office 97, which 75 percent of the respondents use. The browser suite's e-mail clients—Netscape Messenger and Outlook Express—wind up in a dead heat

ware package are averaged to make a score for that software application. Each package's score on that question is then compared with the *overall average* for all packages in the same category. Statistical tests (t-tests) are used to compare differences between these mean averages (each product's score versus the overall average) and to establish whether those differences are statistically significant. See the sidebar "How We Surveyed" in the Desktops and Notebooks section of this Service and Reliability report for more details on t-tests and our survey methodology.

How We Surveyed

In our 1999 subscriber survey, respondents were asked to indicate which software applications they had installed and used most often in each of five categories: operating systems, application suites, Web browsers, Internet e-mail, and corporate messaging. They rated their overall satisfaction, their satisfaction with technical support in general, and their satisfaction with a number of specific types of technical support, using a scale from 1 ("not at all satisfied") to 10 ("very satisfied").

On each survey question, the individual readers' ratings for each soft-

ware package are averaged to make a score for that software application. Each package's score on that question is then compared with the *overall average* for all packages in the same category. Statistical tests (t-tests) are used to compare differences between these mean averages (each product's score versus the overall average) and to establish whether those differences are statistically significant. See the sidebar "How We Surveyed" in the Desktops and Notebooks section of this Service and Reliability report for more details on t-tests and our survey methodology.

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tions such as Microsoft HotMail.

Usage of Internet e-mail clients is evenly divided between home and work. The exception to this is America Online; about twice as many readers say they use AOL at home as at work.

As we've seen in other categories, the software the most people use is not necessarily the most popular product. Once again this year, a loyal group of Eudora users put the client on top, with above-average scores for overall satisfaction and likelihood to recommend; its scores are average for technical support. By contrast, Outlook receives worse-than-average scores for overall satisfaction and likelihood to recommend. It also receives a worse-than-average score for overall technical support, and 24 percent of the users report having needed technical support in the past 12 months. Interestingly, subscribers to AOL give it similarly poor marks, although it ekes out an average score for overall technical support. For more on AOL, see this year's new section on Internet service providers.

Curiously, the most

widely used

products in nearly all major categories are often not the ones that are delivering the

highest level of satisfaction.



CORPORATE MESSAGING

The category we call *corporate messaging* focuses on the messaging solutions that are used at work, especially in larger organizations. In addition to e-mail, these products typically include such features as group scheduling, threaded discussions, and the ability to create custom applica-

tions. We included the four leading messaging products: Novell's GroupWise, Lotus cc:Mail, Lotus Notes, and Microsoft Exchange.

The largest segment of respondents (41 percent) say they use Exchange, with Notes trailing at 20 percent, cc:Mail at 12 percent, and GroupWise at 11 percent. Although these results are similar to last year's, they are a little puzzling because they don't mesh with the market as a whole, where Notes still holds the edge over Exchange.

In this category of our survey, Microsoft's solution is not only the most used product, it is also the most popular. Exchange garners better-than-average scores for both overall satisfaction and the likelihood of being recommended to others. In general, all products' scores are average for both overall satisfaction and technical support. The only exception is cc:Mail, which lags behind the competition. Although Lotus still develops and supports this long-standing product, the company is primarily focused on Notes and the Domino server. **PC**

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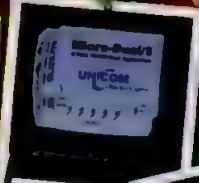
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ISPs

SUPPORT & SATISFACTION

FIND OUT WHICH INTERNET SERVICE PROVIDERS OFFER FAST, RELIABLE ACCESS, TOP-NOTCH TECHNICAL SUPPORT, AND COMPELLING CONTENT.

By Monique Mehta

THE INTERNET HAS BECOME a part of everything we do. So it only makes sense to include in our annual survey of user satisfaction the companies that are bringing the Internet to your desk or doorstep. That's exactly what we've done this year with scores for 18 leading Internet service providers (ISPs), covering not only user satisfaction but also the top reasons for choosing an ISP, connection issues, and other services.

There are many choices for Internet access—most Web directories list more than 5,000 providers in the U.S.—and the results of our survey reflect this fragmented market. The top four among subscribers—America Online, AT&T WorldNet Service, MSN Internet Access, and CompuServe—together account for 33 percent of the responding readers. But we've also received responses for an additional 22 ISPs we list on our survey (only those for which we received sufficient responses to ensure statistical validity are reported here). And another 42 percent say they use service providers not listed on our survey. The only significant leader among our readers is AOL, which has three times as many subscribers as its closest competitor, WorldNet.

In general, *PC Magazine* subscribers seem to be satisfied with their ISPs. The average score for ISPs is 8.1 (on a scale of 1 to 10) for both overall satisfaction and satisfaction with the original setup. This high score suggests that ISPs have made a lot of progress in making it easy to get online for the first time—a process that once intimidated many users.

Although users have no quarrel with the accuracy of their bills, they are slightly less sat-

isfied overall with the cost of Internet access, as well as the technical support that ISPs provide. And though the respondents are generally satisfied with the time required to get a connection and with the reliability of connections, the average scores for satisfaction with connection speeds and the time it takes to down-

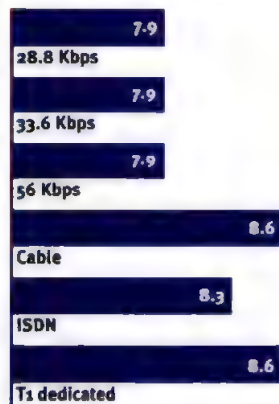
ISP Scores: Satisfaction

▲ Significantly better than average
Average
● Significantly worse than average

	Setup	Rates	Technical support	Overall satisfaction
America Online	8.1	6.8	7.0	7.4
AT&T WorldNet	8.2	7.9	7.7	8.3
@Home	8.1	7.4	7.8	8.6
Bell Atlantic.net	8.5	7.5	7.9	8.1
BellSouth.net	8.2	7.9	7.8	8.2
Cable & Wireless	7.7	7.8	7.2	7.7
CompuServe	8.3	6.9	7.4	7.4
EarthLink Network	8.1	8.0	8.5	8.2
Erols Internet	8.4	8.8	8.0	8.5
FlashNet	8.4	8.6	7.6	8.3
GTE	8.1	7.3	7.5	7.5
IBM	8.4	8.2	8.6	8.7
MediaOne	8.5	7.3	8.0	8.5
MindSpring	8.1	8.1	8.7	8.5
MSN Internet	8.1	7.8	7.3	7.8
Netcom	8.1	8.0	7.6	8.1
Prodigy Internet	8.1	8.4	7.5	8.1
Road Runner	8.4	6.6	7.6	8.5
AVERAGE	8.1	7.7	7.8	8.1

Satisfaction by Connection

The faster the better when it comes to Internet access.



We received fewer than 50 responses for DSL and satellite.

Our Contributors: MONIQUE MEHTA is the research manager at *PC Magazine*. DIANE JECKER was the project leader, and JOHN MORRIS was the associate editor in charge of this story.

load Web pages are slightly worse.

PC Magazine subscribers love speed, and some of the highest satisfaction scores are achieved by the providers of broadband access. These include @Home, MediaOne, and Road Runner, each of which specializes in cable access, which is anywhere from 13 to 29 times as fast as the V.90 (56-Kbps) access that the other dial-up access providers offer. All three of these service providers receive above-average scores for overall satisfaction—another clear indication that fast access is one of the keys to ISP customer satisfaction. The other services that receive high scores overall include WorldNet, Erols Internet, IBM, and MindSpring.

We suspect that performance also plays a big role in user satisfaction with dial-up services, because many of the same high-scoring dial-up ISPs also came out on top in performance tests conducted by Inverse Network Technologies, a well-known industry measurement service, for our recent roundup "At Your Internet Service" (April 20, 1999). In particular, WorldNet—our Editors' Choice—had the lowest call-failure rates, along with Web page download times well below the industry average.

On the flip side, the services that do not fare well on our survey are the online services and former online services, including America Online, CompuServe (now owned by AOL), and MSN Internet Access, the dial-up access service of MSN.com. Curiously, more readers use AOL than any other ISP, yet it consistently receives worse-than-average scores across the board, including those for overall satisfaction and satisfaction with rates, billing accuracy, service promptness, technical support, and all connection criteria.

One possible reason is that users are willing to put up with connection problems to get access to the special content that online services deliver. Nearly a third of AOL subscribers and half of

Reasons for Choosing an ISP

	Price	Reputation	Recommendation from friend	Content	Range of services	Availability of local access numbers	Speed of access	Other
America Online	32%	32%	17%	29%	23%	30%	6%	10%
AT&T WorldNet Service	46%	52%	11%	5%	9%	31%	16%	10%
@Home	31%	7%	14%	2%	7%	8%	97%	12%
Bell Atlantic.net	32%	20%	11%	1%	8%	53%	34%	13%
BellSouth.net	37%	44%	14%	6%	9%	20%	31%	18%
Cable & Wireless	46%	17%	11%	2%	6%	30%	35%	19%
CompuServe	16%	39%	17%	48%	17%	32%	4%	7%
EarthLink Network	37%	31%	25%	6%	12%	35%	21%	11%
Erols Internet	80%	20%	17%	0%	6%	37%	19%	4%
FlashNet	87%	12%	33%	2%	4%	25%	21%	6%
GTE	42%	13%	19%	7%	4%	42%	20%	19%
IBM	28%	45%	13%	3%	8%	26%	24%	20%
MediaOne	30%	6%	10%	7%	6%	13%	96%	7%
MindSpring	25%	44%	38%	2%	12%	19%	22%	8%
MSN Internet	39%	41%	12%	14%	15%	27%	19%	11%
Netcom	42%	16%	35%	4%	9%	36%	11%	6%
Prodigy Internet	48%	24%	13%	18%	14%	46%	16%	8%
Road Runner	28%	7%	17%	6%	7%	6%	97%	11%
AVERAGE	40%	26%	18%	9%	10%	29%	33%	11%

CompuServe subscribers cite content as the top reason for choosing their ISPs. Similarly, AOL and CompuServe are among the only three ISPs to receive above-average scores for satisfaction with discussion forums and other special content (MindSpring is the third).

Obviously, there's a lot more to an ISP than an access number. Fast, reliable access is critical, but many other ingredients go into the mix, depending on how you use the Internet. Read on to find out how your ISP stacks up in all these categories.

USER SATISFACTION

The standouts in our overall measures of user satisfaction are obvious. IBM and MindSpring receive above-average

scores in all four categories: setup, rates, technical support, and overall satisfaction. Not far behind is Erols Internet, with above-average scores in three of these categories; it is average for technical support. WorldNet gets above-average scores for overall satisfaction and pricing but average scores for setup and support. Not only does AOL receive a worse-than-average score for overall satisfaction, it's also worse than average in three of our four specific measures of satisfaction; it is average for setup. Similarly, CompuServe is worse than average across the board. CompuServe 2000, which was released too late to have much impact on our survey, includes an improved setup borrowed from AOL. Like AOL and CompuServe, MSN receives below-average scores for overall satisfaction and technical support.

In most cases, the fast-access services (@Home, MediaOne, and Road Runner) garner better-than-average scores only for overall satisfaction and for connections. Users are clearly choosing these providers for fast access only, and not for such factors as setup, technical support, or

Overall, readers are more interested in reliable access to the Internet than in proprietary services provided by online services.



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ISP Scores: Connections

- Significantly better than average
- Average
- Significantly worse than average

	Connections during business hours*	Connections during evening hours**	Connections during overnight hours†	Time to get connected	Connection speeds	Connection reliability	Web page download speed
America Online	8.1	6.3	8.1	7.1	6.8	6.8	6.2
AT&T WorldNet Service	8.6	8.0	8.9	8.3	7.7	8.6	7.2
@Home	9.6	9.4	9.7	9.8	9.5	9.5	9.3
Bell Atlantic.net	8.8	8.2	8.8	8.6	8.2	8.6	7.5
BellSouth.net	8.8	8.2	9.1	8.7	8.0	8.4	7.5
Cable & Wireless	8.6	8.4	8.7	8.5	7.2	8.3	7.0
CompuServe	8.2	7.9	8.7	8.4	7.2	8.3	6.2
EarthLink Network	8.4	7.5	8.6	8.1	7.7	7.8	7.1
Erols Internet	8.8	8.4	9.1	8.7	8.1	8.4	7.3
FlashNet	8.4	7.8	8.8	8.5	7.6	8.0	6.8
GTE	8.3	7.6	8.7	7.8	7.8	7.7	6.9
IBM	9.0	8.9	9.2	9.1	8.4	9.0	7.6
MediaOne	9.4	9.1	9.4	9.4	9.3	9.5	9.5
MindSpring	8.8	8.2	9.1	8.4	8.0	8.6	7.5
MSN Internet	8.1	6.8	8.4	7.7	7.4	8.2	6.9
Netcom	8.3	7.9	8.8	8.3	7.4	8.1	6.8
Prodigy Internet	8.1	7.6	8.7	8.3	7.8	8.0	7.1
Road Runner	9.4	9.2	9.5	9.7	9.0	9.4	9.3
AVERAGE	8.7	8.1	8.9	8.5	7.8	8.4	7.4

* 9:00a-4:59p. ** 5:00p-9:59p. † 10:00p-8:59a.

price. By contrast, the dial-up ISPs that are above average overall—WorldNet, Erols, IBM, and MindSpring—are also above average in other areas. In fact, IBM is above average in all four general satisfaction categories—and in user satisfaction with connections at all times of day.

Only two ISPs, EarthLink and MindSpring, rank better than average for technical support. Both these services are known for a sense of community and customer support that has engendered a loyal following.

REASONS FOR CHOOSING AN ISP

Among the top reasons for choosing a particular provider are price (40 percent), speed of access (33 percent), availability of local-access numbers (29 percent), and reputation (26 percent). Predictably, those who are using @Home, MediaOne, or Road Runner do so because they have a need for speed: 97 percent of these users

say speed was their top reason for choosing their services.

Less critical factors include content and the range of services offered—both of which are cited by 10 percent or fewer. This suggests that *PC Magazine* readers are primarily interested in fast, reliable access to the Internet and not in proprietary content provided by online services or extra services such as Web page hosting.

Readers say they chose WorldNet,

IBM, and MindSpring for their reputations. As noted above, few readers say they chose their ISPs based on the content offered. The exceptions to this rule are the online services (and former online services) that have spent years cultivating their own content. Users of CompuServe (48 percent), America Online (29 percent), and Prodigy (18 percent) choose these services for content; the average for all ISPs is just 9 percent. All these services offer premium content not available elsewhere on the Web—or at least not in such a user-friendly format.

FlashNet and Erols are the value leaders: 87 and 80 percent, respectively, of those surveyed say they chose these providers for price (the average for all is 40 percent). Both ISPs offer special deals for subscribers who pay for a year or more of Internet access up front. These deals can reduce the price of Internet access from the standard \$20 a month to about \$15 a month or less.

CONNECTION ISSUES

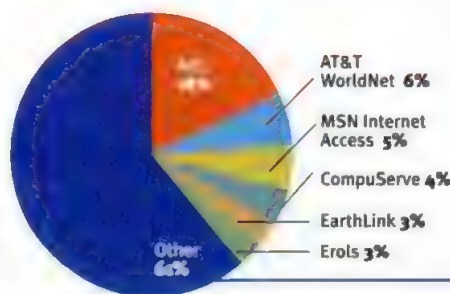
One of the major deciding factors in choosing an ISP is the quality of the connections. If you can't get connected and stay connected at satisfactory speeds, nothing else really matters.

We asked readers to rate their satisfaction with connections at three different times of day (business hours, evening, and overnight). The evening hours are the busiest for dial-up ISPs—when we ran tests for our April 20 roundup, the highest call-failure rates were in the evening—so it is not surprising that the average score for 5:00 to 9:59 P.M. is worse than at other times of day. We also asked subscribers to rate their satisfaction with the time required to get connected and with the speed and reliability of connections.

Not surprisingly, the fast-connection

Top ISPs Among Readers

There's no lack of choices out there for Internet access. Aside from America Online, no single ISP is used by even 10 percent of our readers.



Other ISPs used by 1 percent of readers or more:

@Home
Bell Atlantic.net
BellSouth.net
Cable & Wireless
Concentric
GTE
IBM Internet Connection
MindSpring
Netcom
Prodigy
Road Runner

Source: PC Magazine's Support and Satisfaction Survey.

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services—@Home, MediaOne, and Road Runner—excel on the connection issues. The only dial-up ISP that stands out is IBM, which receives better-than-average scores nearly across the board.

At the opposite extreme, AOL is the only service provider to get worse-than-average scores on all connection questions. MSN, EarthLink Network, and CompuServe also struggle on connection issues. All four of these ISPs also had trouble on Inverse Network Technologies' connection performance tests, reported in our issue of April 20. This fact confirms the close correlation between actual connection performance and user satisfaction on connection-related issues.

The one exception is satisfaction with the speed at which Web pages download. On this question, AOL's score is worse than average. But AOL has some of the fastest page download times of all leading ISPs, thanks to special caching and compression technology (see our April 20 issue). There are a couple of possible reasons for this discrepancy. First, AOL's poor performance on other connection issues could be coloring readers' perceptions of Web page download times. More likely, though, is that AOL's own graphically intensive pages could be dragging down the service's user satisfaction level for Web pages in general.

OTHER SERVICES

In our final section, we asked readers to gauge their satisfaction with the other services that ISPs offer, including e-mail, discussion forums, filtering tools, and Web page hosting.

Overall satisfaction with e-mail service is relatively high (8.6). Among dial-up providers, FlashNet, IBM, and Mind-

ISP Scores: Services

	 Significantly better than average	 Average	 Significantly worse than average	Satisfaction with e-mail service	Satisfaction with e-mail software	Satisfaction with discussion forums	Satisfaction with filtering tools	Satisfaction with Web publishing tools	Percent planning to create Web page	
America Online				8.2					6.7	28%
AT&T WorldNet Service				8.7					6.9	33%
@Home				8.9					6.5	51%
Bell Atlantic.net				8.3					5.7	18%
BellSouth.net				8.7					6.8	24%
Cable & Wireless				8.2					4.7	20%
CompuServe				8.0					5.6	22%
EarthLink Network				8.5					7.4	58%
Erols Internet				8.8					6.7	32%
FlashNet				9.0					6.8	52%
GTE				8.3					6.6	25%
IBM				8.9					7.7	15%
MediaOne				8.7					6.9	51%
MindSpring				9.1					7.2	42%
MSN Internet				8.3					6.8	14%
Netcom				8.8					6.4	32%
Prodigy Internet				8.4					7.1	37%
Road Runner				8.6					6.6	42%
AVERAGE				8.6	8.0	7.2	7.2	6.6	33%	

Spring all receive better-than-average scores. The ISPs with proprietary e-mail systems, AOL and CompuServe, are both worse than average. MSN, which also uses a proprietary e-mail system, likewise scores worse than average (the service employs the standard Outlook Express e-mail client).

The one place that AOL and CompuServe do well is in satisfaction with forums and other content. Both receive better-than-average scores in this area.

Only about a third of our respondents are planning to put up their own Web pages, so it's not surprising that most of them don't know how much space their ISPs provide. The exceptions are subscribers to @Home, EarthLink, FlashNet, and MediaOne. More than half of these subscribers do plan to create their own Web pages. EarthLink, IBM, and MindSpring all receive better-than-average scores for the tools they provide for building Web pages. **PC**

How We Surveyed

In our 1999 subscriber survey, respondents were asked to rate their current home ISPs for a variety of criteria. Respondents rated overall satisfaction and satisfaction with technical support, prices, and other services such as e-mail. In addition, we asked these readers to rate their ISPs on connection issues. All these criteria were rated using a scale from 1 ("not at all satisfied") to 10 ("very satisfied"). In addition, we asked readers to name their top reasons for choosing their current ISPs.

On each survey question, the individual readers' ratings

for each Internet service provider are averaged to make a score for that ISP. Each ISP's score on the question is then compared with the overall average for that measure. Statistical tests (t-tests) are used to compare differences between these mean averages (each ISP's score versus the overall average) and to establish whether those differences are statistically significant. See the sidebar "How We Surveyed" in the Desktops and Notebooks section of this Service and Reliability report for more details on t-tests and our survey methodology.



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SOLUTIONS

TUTOR

MP3: Music on Your PC



You've probably heard of MP3 by now: Here's how to download, play, and record your favorite tunes on your PC's sound system.

By John Hedtke

Just about the hottest thing on the Internet right now is MP3. It's so hot, in fact, that *MP3*—the most popular format for downloaded music—is the second-most-popular search term on search engines. MP3 files make using your computer fun; they're easy to use, and (despite what you may have heard) they're not necessarily illegal. We'll tell you everything you need to know in order to download, play, and record MP3 files.

WHAT IS MP3?

MPEG (pronounced *EM-peg*—an acronym for *Motion Picture Experts Group*) is a set of standards for compressing and storing digital audio and video. MP3 is short for "MPEG Audio Layer 3," and it identifies a way to store digital audio files. MP3 files give you CD-quality sound in a file format that requires roughly 1 megabyte for every minute of sound. (CDs and WAV files, by contrast, require about 11MB per minute.) This means that a single song or track in MP3 format usually takes up between 3 and 5 megabytes, a reasonable download even at 28.8 Kbps. Because of this, a profusion of MP3 Web sites, newsgroups, and FTP sites have sprouted up across the Internet. This also means that it is possible to create a DVD disk containing over 80 hours of music.

Regardless of where a sound comes from, what you actually *hear* is analog sound. Computers translate and store this information as digital sound, however. This is done through *sampling*—the process of taking a snapshot of the sound many times per second. CDs store information in a digital audio format known as CD-DA, which is very similar to the standard WAV format and samples 44,000 times per second.

MP3 files are based on *psychoacoustics*—the study of how the human brain perceives sound. This science has determined that not all of the sound we hear is perceived by the brain. To create an MP3 file, an MP3 encoder reads a WAV file and then strips out the parts that you won't miss hearing.

For example, most people can't hear sounds above 16 kHz, so the encoder strips out any sounds above a preset threshold level. Loud sounds will mask quieter sounds at or near the same frequency; the encoder removes these, too. By whittling away the parts you don't hear, the encoder creates a file that sounds almost the same but is dramatically smaller.

An MP3 file can also contain information about the file itself in a *tag*. The tag can contain things like the artist's name, a graphic (usually the CD cover art), a URL for more information, another URL where you can buy the CD, the song's lyrics, the genre, and more.

USER TO USER



Make Microsoft Word forms stay one size; troubleshoot Direct Cable Connection; a macro that selects a set range size; use Excel's #VALUE! error code; counting rows in Access reports. *Page 243.*

UTILITIES



JumpToIt gives you quick and easy access to a group of your favorite links from the system tray. It also includes a full-featured database for storing and managing your links, with drag-and-drop and Clipboard capabilities. *Page 251.*

INTERNET BUILDER



Meta tags are an underutilized HTML feature; they offer powerful techniques for getting your Web site the attention it deserves. Not only do they allow you to store information about your pages in the HTML, meta tags can also control things like when a page is refreshed and where it will appear in search engines. *Page 253.*

PC TECH



Sure you can use Internet Explorer 5 to browse the Web, but technologies such as DHTML and XML make it suitable as a platform for applications independent of the Web too. *Page 258.*

More on the Web:
You'll find all of the articles, examples, and code files in this section at PC Tech online.

www.pcmag.com/pctech



MP3 REQUIREMENTS

To play MP3 files, you'll need at least a 75-MHz Pentium computer with 16MB of RAM (creating MP3 files requires a Pentium/133 or better with 32MB of RAM), a 16-bit sound card, a CD-ROM drive, and speakers or headphones. You'll also need a lot of hard disk space to store MP3 files: At 3 to 5 megabytes per file, you can fill up a hard disk very quickly. Budgeting a couple of gigabytes of disk space is not unreasonable.

The most important piece of MP3 software is the *player*, which decodes an MP3 file and outputs the sound to your sound card and therefore to your speakers. Many players offer additional features, including spectrum analyzers, equalizers, frequency displays, and so on. One of the neatest features of some players is the ability to create your own user interfaces, known as *skins* or *themes*. The most popular standalone MP3 players for Windows are Winamp and Sonique. Most players also have built-in *playlist editors*, which let you create and save lists of the songs you want to play.

To create your own MP3 files, you'll need a *ripper* and an *encoder*. The ripper takes a song from the CD and turns it into a WAV file, and the *encoder* converts the WAV file into an MP3 file. Many MP3 products contain both rippers and encoders, such as Audiograbber (or Audio-Catalyst) and MusicMatch Jukebox.

PLAYING AN MP3 FILE

The standard Windows Media Player will actually play MP3 files, but it doesn't have any of the features you'll probably want in a player. We recommend you go to www.zdnet.com/swlib/topics/mp3.html and download one of the full-featured MP3 players mentioned earlier. For this discussion, we'll use MusicMatch Jukebox.

To play an MP3 file, double-click its icon in Windows Explorer. MusicMatch Jukebox will start playing the file. The controls for MusicMatch Jukebox (and every other MP3 player) are modeled on those of a cassette deck. If there's cover art in the MP3 tag, it appears to the right of the controls. The MP3 file you are playing will be highlighted in the playlist window to the right side of the art.

You can also view the lyrics, notes, and author bio if they're in the MP3 file's tag by clicking the *Track Info* button at the bottom of the screen, which displays the *Track Info* window. As you collect MP3 files (and you will!), you'll want to keep them in a database so you can flip through them easily. The Music Library, which appears when you click the *Music Library* button (the one with a picture of a note on it), lets you keep track of your MP3 files. You can sort them by category

and select MP3 files to play.

That's about all there is to playing MP3 files. You can use any of a number of great players, including Winamp and Sonique, but the principles are pretty much the same regardless of the player.

Playing MP3 files requires your computer's undivided attention. If you start another program while you're playing a file, the sound may drop out briefly: This is not harmful, but it is annoying. If you play a lot of MP3 files, you'll also want to consider getting a good set of speakers with bass response for your computer. (You can also plug your computer into your sound system and play MP3 files through your stereo's speakers.)

FINDING MP3 FILES ONLINE

MP3 files aren't illegal just because they're MP3 files, but there are many files that violate copyrights and therefore are illegal. (Almost everything found on MP3 newsgroups falls into this category.) If you created an MP3 file

of the latest CD and posted it on the net without the owner's permission, you'd be guilty of a federal crime: a violation of the No Electronic Theft Act of 1997, or NET, which makes it a felony to create or distribute unauthorized digital music. The Recording Industry Association of America (RIAA) is a watchdog organization for this kind of abuse.

As a result of all this attention, most large MP3 sites are distributing only authorized MP3 files. This lets you download files from an enormous number of artists. If you like the music, you can buy the CD—like shareware for music.

The most popular MP3 Web site is www.mp3.com, which gets about a quarter of a million hits a day. MP3.com has an extensive selection of free files for downloading. You can also get the latest MP3 software, read breaking news about MP3 and digital music, and download FAQs and technical information. Other Web sites worth looking at are the audiodiner (www.audiodiner.com), Dimension Music (www.dmusic.com), and Songs.com (www.songs.com).

If you want to download legal MP3 files exclusively, stick to Web sites that have a reputation for authorized MP3 files. You can't always tell if a track is legal just by looking at it.

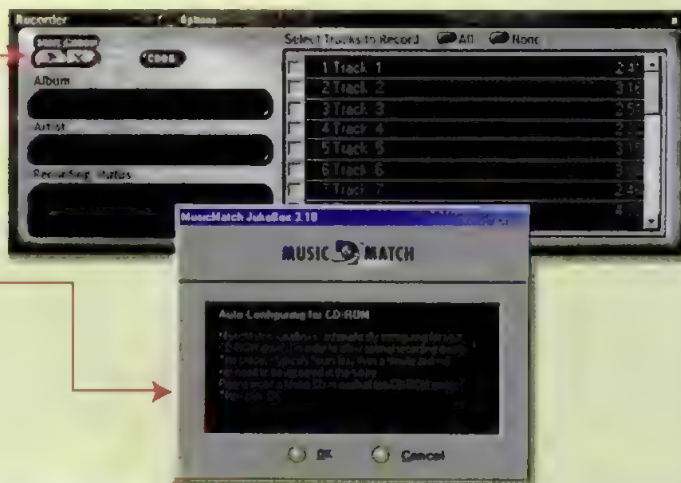
CREATING MP3 FILES FROM CDs

You can create MP3 files from any audio source—CDs, cassettes, or records—but you'll usually create them from audio CDs. The general process for creating an MP3 file is to "rip" the audio information from a CD or other source into a WAV file using a ripper and then to convert the resulting WAV file to MP3 format using an encoder. MusicMatch Jukebox is capable of performing both of these tasks, as shown here.



Step 1. Insert an audio CD into your CD-ROM drive and start MusicMatch Jukebox. If Windows is set up to play an audio CD automatically, you'll need to close the CD-playing program first.

Step 2. Click the *Record* button on the main screen. The first time you do this, MusicMatch Jukebox will run through some auto-configuration steps to determine the best recording settings for your system. Then it will display the recorder dialog.



Besides Web sites, you can also get MP3 files from newsgroups such as *alt.binaries.music.mp3*, *alt.binaries.sounds*, and *alt.binaries.mp3.zappa*. There are currently several dozen newsgroups for MP3 files, and more are being created all the time. The MP3 files you get from newsgroups are almost always unauthorized. Even if you have no intention of downloading illegal MP3 files, you can still use MP3 newsgroups to find out more information about MP3.

You can post a request on the newsgroups to find a specific MP3 file, but you can also use many of the major search engines to find just the file you have in mind. One of the best of these is the Lycos MP3 search engine (www.lycos.com), which has a feature just for MP3 files. MP3.com also has a very good search engine. Scour.Net (www.scour.net) lets you search for MP3 files, as well as many other audio, video, and graphics formats.

CREATE YOUR OWN MP3 FILES

Most users will be interested primarily in turning CD tracks into MP3 files (see the sidebar, "Creating MP3 Files from CDs"), but it's also possible to use vinyl or cassette recordings as your source for an MP3 file.

The most important tip for creating good

MP3 files is to do nothing else with your computer while you're ripping and encoding. The MP3 creation process is computation-intensive; anything else you do on the computer (such as scanning a picture or starting a program) will put a load on the CPU that it may not be able to handle, and this may result in an unwanted blip in the finished sound file. Similarly, make sure that you've got enough free RAM.

Until you've tried the process a few times, you might want to reboot the computer and then create the MP3 files, to start with a clean slate. And make sure that you've got enough room on your hard disk for the WAV files and the MP3 files you're creating. (When you're done you can erase the WAV files, but you need room to work with them.)

You can improve MP3 files' quality by ripping them with a higher sampling rate. The higher the rate the better the sound quality—but the bigger the resulting MP3 file, too. If you want something that sounds better, you can click the *Options* button at the top of the *Recorder* screen to display the *Record Options* screen (Figure 1), then set the compression mode setting to 160 Kbps. The files you create at this setting will be 25 percent larger than the default sampling rate for

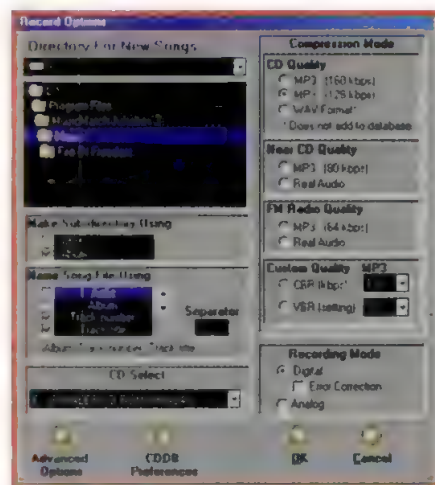


FIGURE 1: The *Record Options* dialog box lets you adjust your MP3 file's sound quality by choosing the compression mode.

MP3 files of 128 Kbps.

Conversely, if you're recording something that doesn't need as much fidelity, you can change the compression-mode setting to a lower sampling rate, such as 80 Kbps. This is adequate for spoken word records (such as comedy) and 78 rpm records. For live recordings of speeches, AM radio broadcasts, and so on, you might even use the 64 Kbps setting. The fidelity won't be high, but you'll be able to squeeze an awful lot of sound into a single megabyte.

PORTABLE MP3 PLAYERS

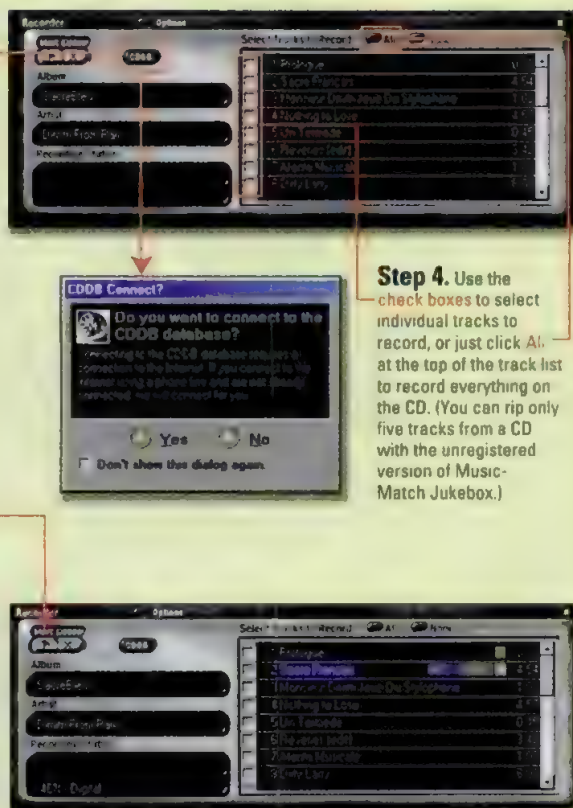
Portable MP3 players let you download up to an hour of songs to a unit smaller than a deck of playing cards. Most players run for about 12 hours on a single double-A battery. They play sound as clearly as any portable CD player, but MP3 players have no moving parts and won't skip if you shake them.

The best known of these is the Diamond Rio PMP300 Portable Music Player from Diamond Multimedia (www.diamondmm.com). The Rio has 32MB of RAM on-board and sells for \$199 (list). The Rio PMP300 Special Edition comes with 64MB of RAM and lists for \$249.95. The Eiger Labs MPMan F10 (www.eigerlabs.com) has 32MB of RAM and sells for \$199; an optional 3V DC adapter costs \$29.95. The \$249.99 Creative Labs Nomad 64 (www.soundblaster.com) has 64MB of RAM like the Rio Special Edition, but it also comes with a built-in FM radio and a digital recorder. **PC**

John Hedtke is the author of *MP3 and the Digital Music Revolution* (Top Floor Publishing, 1999). He can be reached through www.hedtke.com.

Step 3. Enter the CD track information by pressing the **CDDB** button. This will pop up the CDDB Connect? dialog box. CDDB is a huge, free database of information about audio CDs. MusicMatch Jukebox looks up your audio CD in the database and enters information about the CD's tracks. If the CD isn't on CDDB, you can enter the track information yourself. If you don't enter anything, fields are called Track 1, Track 2, and so on. (Leaving them this way is a bad idea, because MusicMatch Jukebox uses these titles for the filenames; the next time you record a CD with default names, MusicMatch Jukebox will overwrite the files.)

Step 5. Click the **Start** button to begin recording. As MusicMatch Jukebox records each track, you'll see a progress bar to the right of the track you're recording. When MusicMatch Jukebox successfully completes recording a track, it will display a green block in the progress bar. (A yellow block means MusicMatch Jukebox had some problems it was able to correct, and a red block means the recording failed and will need to be redone.) When MusicMatch Jukebox is done, it adds the new MP3 files to the Music Library.



Step 4. Use the check boxes to select individual tracks to record, or just click **All** at the top of the track list to record everything on the CD. (You can rip only five tracks from a CD with the unregistered version of MusicMatch Jukebox.)



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USER TO USER

Limit Word's Form Fields to One Line

I have a problem with Microsoft Word's forms: If you're filling in a *Text* form field and hit the Enter key, Word will insert a paragraph return in the field and push everything after the field down one line. If there's more text or more fields on the same line, they will also move to the next line.

This can throw off the layout of a form, turning a one-page form into two or more pages, and making it impossible to predict which page of a multipage form a field is on. This is particularly annoying, since it's so easy to hit the Enter key instead of the Tab key when you're finished filling in a field and mean to move on to the next. Is there any way to prevent Word from pushing text down the page when a user hits the Enter key?

Jeremy Rugg
via the Internet

PC Use a table as the framework for the form and set the rows in the table to an exact height. This won't prevent you from hitting the Enter key and starting a new line in a field, but it will keep the new line from increasing the row height and moving everything after the field down the page. It will also prevent any other text or fields appearing later in the same row from being pushed to the next row.

Start by creating the text for the form along with the table, leaving out the form fields but leaving room for them in the table. Use whatever table-creation tools you feel most comfortable with, choosing commands from the *Table* menu or the *Tables and Borders* toolbar to merge or split cells as needed. (And don't forget that you can use the column markers on the Word ruler to adjust individual cell width.)

You can put a label and field—such as the label "Name" and a field into which to type

the name—in either one cell or two. In general, it doesn't matter which approach you use in those cases where you don't want a field to wrap to the next line (as in fields 1, 3, and 4 in Figure 1). You'll want both label and field in the same cell where you expect a multiline answer as continuous text and want the answer to wrap under the label to give users maximum space in which to type text (as in fields 6 and 7 in the figure). You'll want them in different cells in cases such as addresses, where you expect a multiline answer but want all the lines in the field left-justified (as in fields 2 and 5 in the figure).

Using a table for a framework also lets you add borders around each question and answer, as is common on printed fill-in-the-blank forms. In some cases, however, you may not want to use borders at all, and in most cases you'll want to hide at least some borders. Be sure to set Word to show gridlines (with

Field 1: This is the first field. If I hit enter, the cell will not change height!	
Field 2: This is the first line! This is the second line! This is the third line!	Field 3: Another one-line field! Field 4: Still another one-line field! Field 5: This is the first line for this field! This is the second line.
Field 6: This field is designed to let the text wrap under the field label so you can type continuous text.	Field 7: This field is also designed to let the text wrap under the field label so you can type continuous text.

FIGURE 1: If you use a table for your Microsoft Word 97 form, you can ensure that long field entries won't push down subsequent fields.

the *Table | Show Gridlines* command) so you can easily see the cells while you're designing the form. In Figure 1, the dark lines are borders. The light lines are gridlines.

After you've created the form, you can add the form fields. Briefly, for those who aren't familiar with form fields, in Word 97 you have to add form fields through the *Forms* toolbar. To bring up the toolbar, choose *View | Toolbars*, then *Forms*. There are several buttons on the toolbar, including some for inserting tables and frames, but the most important for creat-

ing forms are the first three—for inserting *Text* form fields, *Check Box* form fields, and *Drop-Down* form fields.

For this discussion, I'll assume that you're interested only in *Text* form fields. To insert each field, move the cursor to the spot where you want the field and click on the leftmost button in the toolbar. This will insert a *Text* form field using default settings. To modify the settings, double-click on the field to open the *Text Form Field Options* dialog. You can then set options like the type of text (including *Regular Text*, *Number*, *Date*, and *Calculation*), the default text to use, the maximum length for the field, and so on.

Next, you need to set the height for all the rows that shouldn't grow larger. Assuming that you want to set all the rows' heights, move to the first row and choose *Table | Select Row*, then *Table | Cell Height and Width*, then the *Row* tab. Go to the *Height of Row* drop-down list and choose *Exactly*. Word will automatically fill in the current height for the row. You can then choose *Next Row* and repeat the process for each row in the table. (If all the rows are the same height, you can simply select the entire table and set all the rows to *Exactly* with one command. Similarly, if several

adjacent rows are the same height, you can select all the adjacent rows and give the command once to set all selected rows.)

Finally, to use the form, you have to protect it for forms. Either click on the rightmost button in the *Forms* toolbar or choose *Tools | Protect Document*, choose *Forms*, and choose *OK*. (Using the menu commands also gives you the option of setting a password.) You can now save the file as a template, close it, and use it by choosing *File | New*, selecting the form as the template to use, and choosing *OK*. As you fill in the form, you'll be able to move from field to field using the Tab key. If you accidentally hit the Enter key, the new line will not push the rest of the text down, as demonstrated by fields 1 and 5 in Figure 1. Both end with paragraph markers entered with the Enter key, but neither shows the second row.—M. David Stone

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Direct Cable Won't Connect

I can't get Direct Cable Connection (DCC) to work on my computers using a serial connection on COM2 on both computers. I get an error message saying the guest cannot connect with the host, no matter which computer is set to be the host. What should I check to get this working?

Allen Ridderhoff
via the Internet

PC DCC is included in Windows 95 and 98 as a simple way to provide networking between two computers. It can be cantankerous and relatively slow, and Microsoft's KnowledgeBase (available on the Microsoft Web site) contains numerous articles on how to troubleshoot reluctant connections.

Here are some key elements that you can check in the Network applet of Control Panel: You should make sure that have the Netbui and IPX/SPX protocols installed, and they should have bindings both for Client for Microsoft Networks and for File and Printer Sharing for Microsoft Networks. Also, check the *Identification* tab and make sure that the two computers have different names but the same workgroup name.

Using a serial port also raises a possible hardware concern. By default, COM2 and COM4 share the same hardware interrupt (IRQ) channel. If your system configuration has devices for both COM2 and COM4, you may have an IRQ conflict that prevents the connection from working. You can view your system's IRQ assignments by opening the System applet in Control Panel, choosing the *Device Manager* tab, and then double-clicking on *Computer*. Some newer computers have features that support the sharing of IRQ channels, but older systems don't.

If you do have an IRQ conflict, try reassigning a serial device to another port, but keep in mind that COM1 and COM3 also share an IRQ by default. As a general rule, you can avoid problems by having no more than two serial devices or connections in a computer at a time, and using COM1 and COM2 for these.

Nearly all of these problems can be avoided easily, however, by using a local area network. All you need are two Ethernet cards and a "crossover" cable to connect them. The cost of network cards has plummeted since DCC was first introduced, making this an attractive and affordable alternative. Not only will you get a faster connection between the two computers, but it is also a peer-to-peer connection, which means that you do not have to specify one machine as the host.—*Alfred Poor*



Create a URL Shortcut

Is it possible to put a URL shortcut on the desktop using a batch file or perhaps Visual Basic 5.0?

Bob McIvor
via the Internet

PC The official method for creating a URL shortcut involves calling on COM interfaces and advanced Windows functions. If the URL shortcut file format changes, this may become necessary, but the current format for URL shortcuts is actually very simple and can easily be created using a batch file or a simple VB program. Create a two-line text file with the extension .url. The first line should simply say [InternetShortcut]. The second line should be URL= followed by the desired URL, for example:

```
[InternetShortcut]
URL=http://www.pcmag.com
```

Here's a little batch file that creates a shortcut on the desktop by placing it in the Desktop folder below the Windows folder:

```
@ECHO OFF
SET
linkname=%windir%\desktop\PCMAG.URL
ECHO [InternetShortcut] > %linkname%
ECHO URL=http://www.pcmag.com >>
%linkname%
```

To create a shortcut, just type these lines into a text file and name it, say, Makeurl.bat. Note that this batch file must run under Windows, because it relies on the *windir* environment variable.—*Neil J. Rubenking*

Drive-Letter Ping-Pong

With the falling prices of immense hard disk drives, more and more users are adding second disks—and discovering problems caused by "drive-letter Ping-Pong." The new disk's main partition takes the drive letter right after that of the old disk's main partition, forcing the old disk's other partitions to bump forward one letter.

This Ping-Pong effect stems from the way DOS assigns letters to hard disks. When you partition your disks with *FDISK*, you can create two types of partitions: a Primary DOS Partition

(PDP), which can contain only one logical drive, and an Extended DOS Partition (EDP), which can be subdivided into multiple logical drives. The first hard disk in the system (the "boot drive") must contain a PDP and may contain an EDP. Other hard disks can contain one PDP, one EDP, or one of each.

When DOS boots, it assigns drive letters in the following order: (1) floppy disks (A: and B: are always reserved for floppies); (2) PDPs on each hard disk, in physical order; (3) logical drives in EDPs, again in physical order; (4) compressed volumes created via *DbiSpace* or *DrvSpace*, which load and perform their own drive-letter gymnastics before *Config.sys* is processed; (5) drives created or accessed via device drivers in *Config.sys*; and (6) drives created via *TSRS* in *Autoexec.bat* (such as *MSCDEX* for CD-ROMs).

Suppose your hard disk has one PDP (C:) and one EDP containing a single logical drive (D:). If you then install a second hard disk that contains one PDP and one EDP with four logical drives, here's what happens: C: is the PDP on hard disk 1, D: is the PDP on hard disk 2, E: (formerly D:) is the logical drive in the EDP on hard disk 1, and F: through I: are the logical drives in the EDP on hard disk 2.

The only way to stop your drive letters from Ping-Ponging like this is to repartition the second hard disk. After backing up any files you may have stored on that hard disk, delete the logical drives from the EDP, delete the EDP itself, then delete the PDP. Now create a single EDP and subdivide it into the logical drives you want. Once you do so, the letters on your second hard disk will follow those on the first because the second hard disk no longer contains a PDP.

Greg Wolking
via the Internet

PC When the installation of a new hard disk "pushes" your existing drive letters forward, it can wreak havoc with your system. At best, any *Start* menu or desktop shortcuts that refer to programs on those hard disks won't work. At worst, Windows may fail to find essential system files and may not even be able to start. In most cases you'll notice the problem right away, before you've had time to start loading the new hard disk with programs or data. It's no big deal to change the partitioning (using *FDISK*) when there's no data to back up and restore.

If you've already managed to load up the new hard disk with programs and data files, however, you may want to invest in a modern nondestructive partitioning utility, such as *PartitionMagic* from *PowerQuest* (www.powerquest.com) or *Partition Commander* from *V Communications* (www.v-com.com). It's still a good idea to back up your data before

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using one of these utilities, but they *should* be able to perform all partitioning tasks without losing any of your data. Of course, when you restore the original letters of the old hard disk's additional partitions, the letter of the new drive's first partition will change, causing its own minor version of the "Ping-Pong problem."

The very best time to avoid this problem is before it happens. In the initial setup of the new hard disk, whether you do it yourself or have a technician do it, make sure to create a single Extended DOS Partition and no Primary DOS Partition. You can still divide the EDP into as many partitions as you want, but the letters of your existing partitions won't be forced to change.—*Neil J. Rubenking*

A Set-Size Selection Macro

More than ten times per session, I need to select an area of five cells horizontally by ten cells vertically in different places in my Excel spreadsheet. If I record a macro to do this, the macro records an absolute address and always selects that absolute address. How can I create a macro that selects an area relative to the active cell?

*Elio Villegas
via the Internet*

PC The following VBA procedure will do the trick:

```
Sub select5x10()  
    SelectionString = ActiveCell.Address  
& ":" & ActiveCell.Offset(9, 4)  
.Address  
    Range(SelectionString).Select  
End Sub
```

You'll probably want to assign a keyboard shortcut to this macro, since you'll be using it so often. Note that the macro selects an area extending four columns to the right of, and nine rows below, the active cell. If the current selection is a range—not a single cell—the macro still selects a 5- by 10-cell block from the active cell; it does not extend the entire current range by four columns and nine rows.—*Craig Stinson*

Use Excel's #VALUE! Error Code

I have some data in an Excel cell that consists of letters and numbers. I want to search this cell for a particular letter/number combination. If the combination is found, I want a new cell to say "OK." If it is not found, I want the new cell to say



"NOT." I have tried using Excel's `FIND` function within an `IF` statement. If it finds the value, the new cell says "OK." If it does not find the value, however, I get a `#VALUE!` error, which I cannot use. How do I solve this?

*Ramon Gonzales
via the Internet*

PC You have to add an `ISERR` function to your `IF` and `FIND` functions. `FIND` returns the position at which a substring is found within a larger string. If the substring isn't there, `FIND` returns `#VALUE!`. You don't care about the position of the substring; you care only about whether it's there or not. So you need to distinguish between a `#VALUE!` result and all other results. That's where `ISERR` comes in. `ISERR` returns `true` if its argument generates any form of error constant (`#N/A!`, `#NUM!`, `#VALUE!`, and so on). Otherwise it returns `false`.

So your formula should look like this:

```
=IF(ISERR(FIND("x17",A1,1)),  
"NOT","OK")
```

assuming you're looking for the substring `x17` within the contents of cell `A1`. Make the appropriate substitutions, and you're in business.—*Craig Stinson*

Counting Rows in Access Reports

I have a Microsoft Access 97 database in which there are a number of reports based on a corresponding number of queries. I would like to include in each report's footer a count of the number of records that satisfied the query. It seems kind of crude to count the records manually and write the number on the bottom of the report. Is there a better way?

*Doug Forsyth
via the Internet*

PC You can use the `Count` aggregate function, provided that you wish to place the count in either the report footer or a group footer.

For example, if you're printing a product report and you want to print the number of products for the entire report, place a text box in the report footer and set its Control Source property to

```
=Count([ProductID])
```

The field name, in this case `[ProductID]`, should be one that always has a value. That way, every record is included in the count. If you instead choose a field that doesn't always have a value (some contain a null value, for instance), the count will not include those rows without a value. That's because aggregate functions like `Count` ignore null values in their calculations.

If you must count every row and for some reason you must choose a field that contains null values, use the following expression instead:

```
=Count(Nz[ProductID])
```

The `Nz` function converts nulls to zeros and forces the count to include every row.

If you're using grouped records in your report and you want to count the number of products per group, use the same technique as above but place the text box in the group footer instead of the report footer.

I mentioned above that you could use the `Count` aggregate function in the report footer and in the group footer. Noticeably absent is the page footer. That's because Access doesn't support the use of aggregate functions in the page footer. If you want to print a count of the number of products on a per-page basis, you have to write code. First, you would need to create a text box in the page footer and call it, let's say, `txtPageCount`. Then you'd place code in the Page Header's Format event to initialize the count to zero in preparation for accumulating a count for that page. The code would look like this:

```
Me!txtPageCount = 0
```

Then you'd place a line in the Detail section's Print event to increment the counter. Because the Detail section occurs once for each row, the code would be executed once for each row. The code would look like this:

```
Me!txtPageCount = Me!txtPageCount  
+ 1
```

A sample database that demonstrates counting by page, by group, and by report can be downloaded from PC Magazine Online. Go to www.pcmag.com, click on *Downloads*, then *Issue Archives*, and download the archive for this issue. Look for the file named `Counting Rows.Mdb`. It uses sample data and a report that I modified from Access's Northwind sample database.—*Sal Ricciardi* **PC**

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Quick Access to Web Links

The list of links in your *Favorites* menu can get very long, and you have to open Microsoft Internet Explorer to get to it—an inconvenience if you're working within another application. This issue's utility, **JumpToIt**, gives you tray access to a short list of favorite links, along with a full-featured database for storing and managing your links. JumpToIt lets you load links from either the main window or the tray. To add links to the database, drag or paste them from your favorite Web browser or monitor the clipboard for URLs and save them automatically. A single mouse click lets you

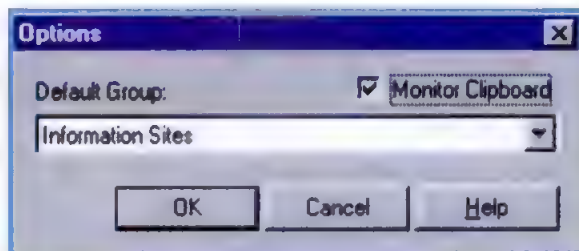
mark the link for the tray menu short list in the main window.

JumpToIt runs under Microsoft Windows 95, Windows 98, and Windows NT 4. An article about how to use JumpToIt and how it was written is available on our Web site at www.pcmag.com/utilities. A link to download the utility and its Microsoft Visual C++ source code can also be found here.

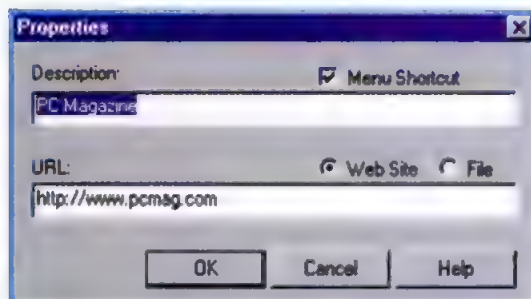
Steven E. Sipe, the author of JumpToIt, is a developer based in Wilmington, North Carolina. Sheryl Canter is the editor of the Utilities column and a contributing editor of PC Magazine.



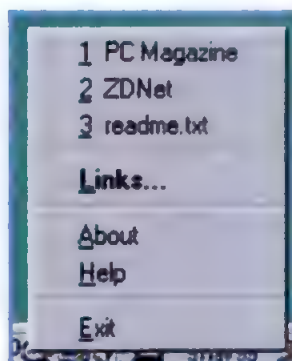
JumpToIt's main window displays the full database of links. The groups are displayed in a tree view in the left-hand pane; the links within each group are displayed on the right. A red check mark on the link icon indicates that it will be displayed in the tray menu.



JumpToIt's Options menu lets you choose whether to monitor the clipboard for links and automatically add them to your database, and where to store them if you do. You can drag and drop these links into other groups at a later time.



Right-click on a link and choose Properties to bring up a dialog box that lets you change a link's description or URL and add or remove it from the tray menu. Similarly, you can right-click on a group and choose Properties to change a group's descriptive name.



JumpToIt's tray menu gives you quick access to a short list of favorite links that you've marked in the main window. To open the main window with the complete list of links, choose the Links menu item or double-click on JumpToIt's tray icon.

How to Get the Files: PC Magazine utilities and other Solutions files are available on the Internet and by mail.

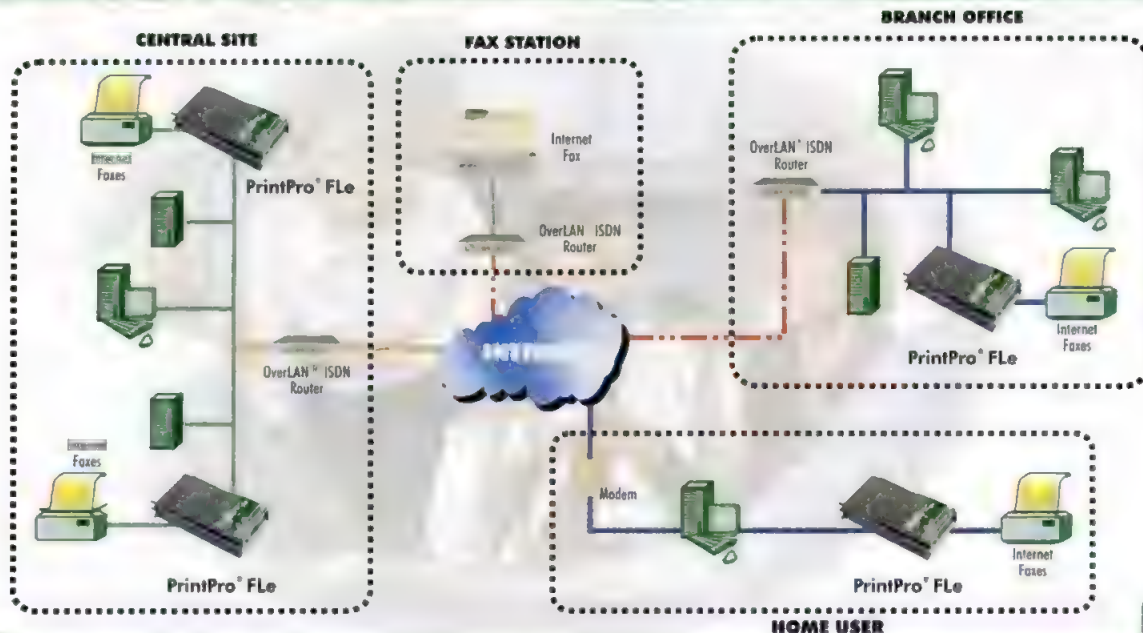
Via the Internet: Go to the PC Magazine home page at www.pcmag.com and click on Downloads, or use our FTP server at <ftp://ftp.zdnet.com/pcmag>.

Via Mail: You can request utilities by fax at 978-772-7133 or write to PC Magazine Utilities, c/o Image Software Services, 67 Buena Vista St., Ayer, MA 01432-5030. For disk requests, there is a limit of six per month.

Support: To obtain help for PC Magazine's free utilities, visit our online discussion area on the Internet (www.pcmag.com/utilities/support.html). The authors of current utilities visit this forum regularly. You may find an answer to your question simply by reading the messages posted there. If the author is not available and the sysops can't answer your question, the Utilities column editor will contact the author for you.

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Connecting people and information



Meta Tags Target Your Pages

By William Robert Stanek

So many Web technologies are being introduced that it's nearly impossible to keep up with them. But at least one cornerstone Web technology has largely been neglected lately: meta tags. Only a meager 20 percent of Web pages use them, but that doesn't mean meta tags are outdated or some new technology is better.

For example, did you know that meta tags can help you create a slide show or control browser caching? Meta tags can also improve your search engine ranking and control the indexing of your Web site—and this is only the beginning. In fact, if you use meta tags correctly they will put you in the driver's seat when it comes to how, when, and why your Web pages are viewed.

METADATA: HISTORY AND SYNTAX

Using standard HTML tags, you can't provide background information about Web content, such as who created a particular page or when it was last modified. HTML is designed primarily to present information, not to record details. The `<META>` tag can hold this higher-level information on Web pages.

A key technology that comes into play whenever you use meta tags is HTTP. The HyperText Transfer Protocol specifies how information is transferred over the Web and used to request Web documents, and how to return responses. Responses are formatted with an HTTP header and body. The header contains information browsers need to interpret the document, such as its content type. The body contains the rest of the document's contents.

Normally, HTTP headers are set automatically by Web servers based on responses to requests for resources. But rather than having the Web server determine which headers are used, you can modify existing headers or create your own using the `HTTP-EQUIV` tag. This lets you customize browser and server behavior. For example, let's say the default content type and character set for the server are `text/html` and `ISO-8859-1` (Western, Latin-1). The server sets this information in an HTTP header as

```
Content-Type: text/html;
Charset=ISO-8859-1
```

With a meta tag, you can override the default content type, setting the default character set to `ISO-8859-5` (Cyrillic) as follows:

```
<META HTTP-EQUIV="Content-Type"
CONTENT="text/html; CHARSET=ISO-
8859-5">
```



META TAGS MAY be hidden from view, but when it comes to getting your page the attention it needs, they're just as important as the page itself.

Now instead of seeing the Latin-1 character set, readers see the Cyrillic character set, which works for the Russian translation of your favorite play. Usually, `HTTP-EQUIV` directives are passed directly to browsers for interpretation. Some Web servers translate the directives into actual HTTP headers automatically, however. If this happens, you may not be able to view the source of a Web page to see its meta tags. `Content-Type` is only one of many similar meta values. Here are a few more:

- `HTTP-EQUIV="Content-Disposition"` specifies an application handler for the file.
- `HTTP-EQUIV="Content-Script-Type"` sets the default scripting language.
- `HTTP-EQUIV="Content-Style-Type"` sets the default stylesheet language.
- `HTTP-EQUIV="Content-Language"` declares the natural language for the page.

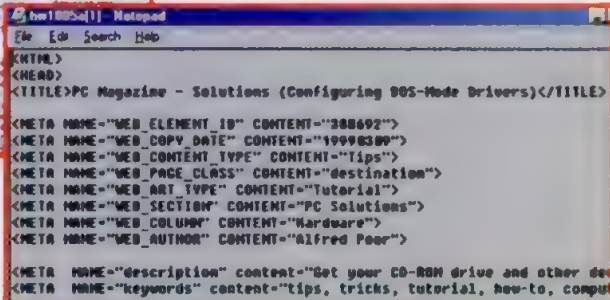
Other meta tag definitions include information pertaining to the HTML version, browser version, Web authoring tools, and search engines. Most of these additional meta tag sources use the `NAME` attribute, which designates supplemental information that doesn't have a related HTTP header. In each of these tags, `NAME` identifies the value and `CONTENT` sets the actual value. The following example sets the author's name:

```
<META NAME="Author"
CONTENT="William R. Stanek">
```

Here are more meta values that use the `NAME` attribute to provide further information:

- `NAME="Copyright"` sets the copyright information.
- `NAME="Generator"` sets the authoring tool that created the page.
- `NAME="Reply-To"` sets the contact e-mail address.

Some browsers and search engines may not be able to interpret your meta tags and will simply ignore them. Meta-information is always added to the page header inside the `<head>` and `</head>` tags, like this:



```
<html>
<head>
<META HTTP-EQUIV="Content-Type"
CONTENT="text/html; CHARSET=windows-
1252">
<META HTTP-EQUIV="Content-Language"
CONTENT="en-us">
<META NAME="Generator"
CONTENT="FrontPage 4.0">
<title>My Web Page</title>
</head>
<body>
—
</body>
</html>
```

New ways of thinking have evolved as a result of meta tags, bringing with them many new standards—standards that are predecessors to breakthrough technologies like RDF

(Resource Description Framework), which provides a framework for describing various types of metadata. Learn more about RDF online at the World Wide Web Consortium's Web site (www.w3.org/rdf).

BEAT THE SEARCH ENGINES

Search engine ratings help bring in customers and revenues. To get the best ratings, use meta tags—it's that simple. Meta tag techniques that'll stack the odds in your favor (fairly, of course) include keyword lists set with `NAME="KEYWORDS"`, descriptions set with `NAME="DESCRIPTION"`, and indexing controls set with `NAME="ROBOTS"`.

When it comes to finding your Web page in a search engine, a `<META>` tag keyword list gives your page a definite advantage. To create a keyword list, use `NAME=KEYWORDS`, such as

```
<META NAME="KEYWORDS"
CONTENT="sports books, history books,
geography books">
```

Remember meta tag keyword lists are normally used in addition to those keywords the search engine gathers from the main page text. So rather than repeating keywords from the main text, concentrate on related topics or variations of the primary keywords. For example, if the keyword is *computer*, use variations such as *PC*, *desktop*, and *notebook*.

You can also use combinations of keywords or short phrases. Don't repeat a keyword several times. Instead create word combinations, such as *net PC*, *notebook computer*, and *hand-held PC*. Watch out, though: Some search engines penalize you for repetition, disregarding the list entirely if you repeat keywords too many times. Excessive repetition of keywords is called *spamdexing* (as in spam indexing), and it's a bad thing. Limit the keyword list to fewer than 1,000 characters and use individual keywords no more than seven times.

Add a description to your page using the `NAME=DESCRIPTION` attribute. The advantage to describing pages in meta tags is that you can provide the exact description rather than having the search engine extrapolate the description from the main text. A good description summarizes the main points of the page in 200 characters or fewer. Because some search engines use page descriptions smaller than 200 characters, try to put the most relevant information first, as you see in the following example:

```
<META NAME="DESCRIPTION" CONTENT="PC
Magazine Online is the #1 destination
for technology information. We're your
independent guide to personal
```



computing and the Internet. Drop by today. See how PC Magazine can make a difference in your life.">

Because of the great increase in multi-lingual search engines, you may want to create language-specific versions of keywords, descriptions, and other metadata. To do this, use the `LANG` attribute to specify a language preference:

- `LANG="en"` British English
- `LANG="en-us"` U.S. English
- `LANG="ko"` Korean
- `LANG="ru"` Russian
- `LANG="zh"` Chinese

You will end up with multiple (but language-specific) entries for certain meta values, such as

```
<META NAME="KEYWORDS" LANG="en-us"
CONTENT="vacation, vacation books">
<META NAME="KEYWORDS" LANG="en"
CONTENT="holiday, holiday books">
```

Most search engines use spiders, crawlers, or other Web beasts to index your pages. These specialized indexers find resources by crawling through the links in pages, starting at the top-level links and moving down through successive levels of links. Unfortunately, search engines may limit the number of pages they index at each Web site or they may index pages you don't want indexed, such as a page that's part of a frame set. Either way you have problems. You may have important pages that aren't indexed and that users won't be able to find easily. Conversely, you may have pages improperly indexed, so users could start their visit in places they shouldn't.

To resolve these problems, use `NAME=ROBOTS`, and then use the following content values to specify how the page should be indexed:

- `ALL` Index the page and all of its links (default)
- `INDEX` Index the page
- `NOINDEX` Don't index the page
- `FOLLOW` Follow the links
- `NOFOLLOW` Don't follow the links

You can specify that the indexer should neither index this document nor analyze it for links as follows:

```
<META NAME="ROBOTS"
CONTENT="NOINDEX, NOFOLLOW">
```

Note that the case used in this example is mandatory. According to the HTML 4.0 specification, index-related keywords and the `ROBOTS` name value should be specified in uppercase. An alternative to using `NAME=ROBOTS` in each Web page is to create a `robots.txt` file and place it in your Web site's main directory. The `robots.txt` file works much like `NAME=ROBOTS` but can be used to specify sets of files and directories to include or exclude from indexing.

MANAGE CONTENT

Meta tags can also help you manage content—and this is an area where every Webmaster should wake up and smell the coffee. Nothing is more annoying than visiting dynamically updated pages that don't load in your browser properly and then having to turn off browser caching to accommodate the Web site. Instead of making users suffer, Webmasters should properly manage content with meta tags, telling browsers when to request newer versions of pages, when not to cache pages, and more.

You tell browsers when to request newer versions of pages by setting an expiration date with `HTTP-EQUIV="EXPIRES"`. A request for a page with a valid time results in the page loading from the cache. On the other hand, if the page has expired, the browser makes a new request for the page to see whether it has been modified. Browsers interpret illegal dates as an immediate expiration. To avoid this, dates must be set in RFC850 format, such as

```
<META HTTP-EQUIV="EXPIRES"
CONTENT="Mon, 12 Apr 1999 10:00:00 GMT">
```

Be careful when using expiration dates. Some indexers delete expired pages from the master index or schedule the page for reindexing. Another way to control caching is to use `Pragma` with a value of "no-cache", which issues the same request as pressing *Reload* in your browser. `No-cache` is the only valid value, and it is used as follows:

```
<META HTTP-EQUIV="pragma"
CONTENT="no-cache">
```

Don't you hate it when other sites display your pages inside their frames? A down and dirty way to avoid this is to use `Window-target` with a value of `_top`, such as

```
<META HTTP-EQUIV="Window-target"
CONTENT="_top">
```

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The `_top` value tells compliant browsers to load the page into the top frame set. This prevents the page from appearing within another framed page.

With the `Set-Cookie` value, you can use meta tags to set cookies in users' browsers. A cookie without an expiration date is temporary and exists only until the user exits the browser. A cookie with a valid expiration date can be used in multiple browser sessions and is saved in the browser's cookie file until it expires. You create a cookie using the following syntax:

```
<META HTTP-EQUIV="Set-Cookie"
CONTENT="name=data; path=path;
expires=Day, DD-MMM-YY HH:MM:SS ZON">
```

where `name` is the cookie name, `data` is the cookie value, `path` is the path within the site where the cookie is valid, and `expires` sets the expiration date. The following is a real-world example of such a cookie:

```
<META HTTP-EQUIV="Set-Cookie"
CONTENT="ACCOUNT=9983373; path=/;
expires=Thursday, 20-May-99 00:15:00
GMT">
```

Meta tags can also be used to rate content

for violence, profanity, and other subjects appropriate only for mature audiences. Two techniques are used: `NAME=Rating` and `HTTP-EQUIV=PICS-Label`. `Rating` is used to assign a simple content rating and has largely been replaced by `PICS-Label`. Platform for Internet Content Selection (PICS) is an official standard of the World Wide Web Consortium. With PICS, you can assign rating levels to content in multiple subject areas. For example the page can be designated as containing fighting (a violence rating), mild expletives (a language rating), and no sexual content (a sex rating) but revealing attire (a nudity rating). Usually, ratings are assigned using a third-party rating system, such as that from SafeSurf (www.safesurf.com) or RSACi (www.rsac.org).

PICS labels are very complex, and you don't create the related meta tags by hand. Instead a rating service will help you create the necessary tags. Rating systems have also been integrated into some Web server soft-

ware, such as Microsoft Internet Information Server.

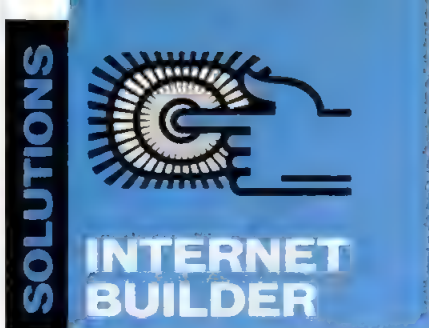
A final content-management meta tag you'll probably want to use is `Refresh`. This tag lets you create a slide show by telling browsers when to reload a document and which URL to retrieve when they do. For example, to tell the browser from `page0.htm` to retrieve `page1.htm` in 5 seconds, type the following:

```
<META HTTP-EQUIV="Refresh"
CONTENT="5;
URL=http://www.tvpress.com/page1.htm">
```

Then in `page1.htm`, tell the browser to retrieve `page2.htm` and so on until you complete the slide show. If the last page has a refresh pointing to `page0.htm`, you can make the slide show repeat.

When you set out to add meta-information to your Web site, start with the home page. After you update the home page and top-level pages, consider adding meta-information to the rest of your site. 

William Stanek is a frequent contributor to PC Magazine and the author of Microsoft Windows NT 4.0 Administrator's Pocket Consultant. He can be contacted at writing@tvpress.com.



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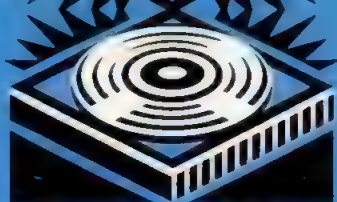
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Developing with Internet Explorer 5.0

By John Lam

We know Web browsers are useful end-user applications, good for searching, browsing, and retrieving information. But until fourth-generation browsers introduced Dynamic HTML (DHTML), browsers provided few services for developers interested in creating Web-based applications. By offering a mechanism for building Web pages with sophisticated user interfaces, DHTML acted as a catalyst, spurring developers to begin considering using the Web to deliver functionality to users. A number of difficulties remained, however. We'll take a look at some of these problems and at the solutions Microsoft Internet Explorer 5 (IE5) provides, focusing on DHTML behaviors and XML support in IE5.

The first and most significant problem developers faced was maintaining a *user session* between the browser and the Web server. A user session might consist of, say, a shopping trip to Amazon.com, in which a user browses for books at the Web site and adds some to a shopping cart. In this case, the session data is the list of books in the shopping cart.

The problem of maintaining a user session and its associated data has typically been solved through Web server services, such as the session objects in Microsoft's Active Server Pages. But this is hardly the only solution to this problem; in fact it is not the best solution. IE5, through its support for the Extensible Markup Language (XML), makes it possible for Web developers to maintain a user session *and* its associated data all within a Dynamic HTML page on the client.

XML also serves as a means for dealing with a related issue: transferring data between the Web browser and the Web server. Until now, you had to transmit data using crude techniques such as HTML form elements. Moreover, if the data to be transferred was structured, developers had to in-

vent ad hoc formats for representing the information. With XML, it's relatively easy to generate XML documents from an application's data; that data will then be processed by IE5's XML processor, saving considerable development effort.

Finally, as Web pages become increasingly sophisticated, developers are confronted with the difficulty of maintaining large quantities of script code. Making use of some lessons

a number of related technologies: HTML defines the structure of the information being conveyed to the user; Cascading Style Sheets (CSS) determines the appearance of that information as it is being rendered; and the Document Object Model (DOM) lets scripting languages such as VBScript and JavaScript interact with the HTML elements in the document. Together, these components make it possible to write client applications that live inside the Web browser.

When IE5 requests an HTML document from a Web server, it establishes an HTTP connection to that server and retrieves the document. The browser then parses the document and retrieves any related information referred to by the document, such as embedded GIF images. In the process of parsing the document, IE5 creates an in-memory image of the document, converting it into an internal tree-like representation (see Figure 1).

Each node of the tree represents an HTML element that behaves as an independent object. These objects have properties and methods as defined by the Document Object Model Level 1 specification (available at www.w3.org/TR/rec-dom-level-1), and they can fire events, which—though this is not formally defined in the specification—is the basis for adding interactivity to the browser.

Application code can manipulate both the individual objects and the overall structure of the tree. This is what puts the “dynamic” in DHTML: Any interactions with individual objects, such as setting properties or calling methods, will be reflected immediately in the rendered document.

Similarly, user interactions with individual objects, such as rolling the mouse over an object, will result in that object firing an event, which can be handled by application code.

When application code manipulates the tree itself, perhaps by adding or replacing nodes, the browser ensures that the document is correctly rerendered to reflect those changes. User interfaces can be built on the fly simply by building strings that contain HTML element sequences and having the browser parse the strings to modify the HTML object tree. Figure 2 illustrates this procedure, using JavaScript to add some HTML button elements to an existing <DIV>



learned in building traditional Windows applications, IE5 introduces a feature called *DHTML behaviors*, which offers the benefits of component-based software development that Visual Basic and Delphi developers have grown accustomed to.

You can think of the new development support in IE5 as part of the ongoing evolution of Dynamic HTML. To understand how all the pieces fit together, let's first look at the role of Dynamic HTML in Web applications.

MAKING HTML DYNAMIC

Dynamic HTML lets you define a user interface in terms of HTML elements and lets users interact with that interface. DHTML consists of

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The DLT 7000 drive allows editors to jump on new customers' projects without wasting time. "Users simply back up the current project, complete the hot one, and then restore and continue work on the original project," Hall explains.

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EVS Broadcast Equipment of Belgium is one of the world's top suppliers of instant-replay systems for broadcasters, and they know the importance of reliability. For EVS, Quantum drives always make the grade, standing up to the abuse you find in any sport-remote-broadcast truck and recording up to six full hours-ample time for any sports broadcast even with multiple camera feeds, impressive special effects, and split-second editing.

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Sports fans the world over agree-EVS scores a goal!

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everything. To meet the needs of such applications, Quantum offers the Rushmore™ Ultra line of high-performance solid state storage solutions.

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- Quantum is entering the rapidly emerging market for storage appliances later this year. This new class of product is aimed at the workgroup level and promises greatly improved ease-of-use and flexibility for end-users implementing storage solutions.

- Quantum is developing system software to provide intelligence in upcoming storage systems and storage devices. Already, Quantum enjoys an early lead in demonstrating self-configuring disk drive appliances within the Jini™ network architecture being developed by Sun Microsystems.

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element in the parsed HTML tree.

The Document Object Model forms the core of DHTML, defining properties and methods for individual objects within the HTML tree, as well as how individual object types (document, paragraph, or list element, for example) can be manipulated through script. It does so by defining one or more *interfaces* to each object type. An interface is simply a grouping of related methods and properties (such as the `HTMLElement` interface that specifies properties and methods common to all HTML elements). In no way, however, does the DOM attempt to stipulate how the objects are to be implemented.

Microsoft chose to use the Component Object Model (COM) to implement the interfaces to the HTML tree objects. This is a good fit, since COM lets developers separate an object's *interface* from its *implementation*: The World Wide Web Consortium defines the interfaces, and Microsoft implements those interfaces for the HTML elements that can be manipulated by the browser.

An important consequence of using COM to implement the interfaces is that Windows developers can leverage their existing knowledge of COM programming. All they have to

understand is how to call methods on COM objects from their favorite programming language or environment. All modern development tools for the Windows platform support calling methods on COM objects, as do Visual Basic, Delphi, Visual C++, and even the Microsoft Java Virtual Machine. And the scripting languages used in Dynamic HTML—VBScript and JavaScript—can also call methods on COM objects. In fact, when you create DHTML pages and manipulate HTML elements on those pages, you're really just calling methods on the underlying COM objects that make up those pages in memory.

ELEMENTS OF STYLE

What defines the appearance of the individual nodes of the HTML tree? The answer is Cascading Style Sheets (CSS). Before CSS, you had to manipulate the property settings of objects individually. That meant a lot of redundant work and opportunity for error.

With CSS, on the other hand, you define a sequence of formatting *rules* that the browser applies to elements of the HTML tree each time it renders the page.

CSS rules are applied in a specific order, with more specific rules overriding less specific rules. HTML elements that are children of other HTML elements will inherit the rules of their parents, unless there are rules in the CSS stylesheet that cause the parent's rules to be overridden. You tie CSS rules to an HTML document by inserting a link in the document to an external file that contains those rules. You can thus define the appearance of not just one page, but entire collections of pages simply by having all of those pages refer to the same CSS file. Not only does this make content more manageable, it also means the client can cache the referenced stylesheet, significantly reducing the amount of bandwidth required to render a page.

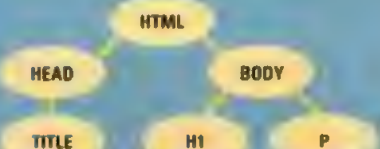
CODES OF BEHAVIOR

What began as a solution for managing the appearance of elements turned out to be much more. With the introduction of DHTML behaviors in IE5, Cascading Style Sheets can also be used to define rules that associate code

Working with IE5

```
<HTML>
<HEAD>
<TITLE>Sample document</TITLE>
</HEAD>
<BODY>
<H1> This is a heading</H1>
<P>This is a paragraph</P>
</BODY>
</HTML>
```

1 Internet Explorer converts HTML documents into an in-memory tree of objects; each node in the tree represents an HTML element.



```
<HTML>
<HEAD>
<TITLE>Sample document</TITLE>
</HEAD>
<BODY><SCRIPT LANGUAGE=JavaScript FOR=window EVENT=onload>
var strButtons;
strButtons = "<INPUT TYPE=Button VALUE='Button 1' ID=btn1>";
strButtons += "<INPUT TYPE=Button VALUE='Button 2' ID=btn2>";
divOutput.innerHTML = strButtons;
</SCRIPT>
<DIV ID=divOutput>
</DIV></BODY>
</HTML>
```

2 This script code adds two additional buttons to the HTML tree.

```
Styles.css
HVAR
{
BEHAVIOR: url ("hilitc.htc")
}
```

```
<PUBLIC:PROPERTY NAME="hilitcColor" />
<PUBLIC:ATTACH EVENT="onmouseover" HANDLER="MouseOver" />
<PUBLIC:ATTACH EVENT="onmouseout" HANDLER="MouseOut" />
<SCRIPT LANGUAGE="javascript">
function MouseOver() {
if( event.srcElement.tagName == "SPAN" ) {
event.srcElement.oldColor = event.srcElement.style.color;
event.srcElement.style.color = hilitcColor;
}
}
function MouseOut() {
if( event.srcElement.tagName == "SPAN" )
event.srcElement.className = event.srcElement.oldColor;
}
</SCRIPT>
```



with specific HTML elements on a page.

Just as CSS lets you separate an HTML element's content from its appearance, DHTML behaviors separate the element's content from the code that specifies the element's behavior, functioning much as ActiveX controls do in traditional programming environments. Not surprisingly, DHTML behaviors are applied to the document using CSS rules. Let's look at an example.

You can write a DHTML behavior entirely in script. Such behaviors are known as *hypertext components* in IE5 and are stored in external script files with an .htc extension. They are "hooked up" at runtime to specific HTML elements, as laid out by the rules in a CSS stylesheet attached to an HTML document. Figure 3 shows a simple hypertext component file that attaches itself to an HTML element and highlights the text within that element whenever the mouse moves over it. This behavior receives both the `onmouseover` and `onmouseout` events from the `SPAN` element to which it is bound. It also exposes a property that lets the programmer specify what color the highlight should be when the mouse moves over the element.

Figure 3 also shows an excerpt from the as-

sociated CSS file, illustrating how IE5 extends CSS stylesheets with the new behavior attribute in which you specify the URL containing the hypertext component file. As you can see, just you can define the appearance of HTML elements, now you can define the behaviors of HTML elements, and not only for a single document, but across an entire family of related documents.

DHTML behaviors aren't limited to script-based hypertext components; they can be written in any language that supports COM. COM objects are typically referenced from HTML documents with the `<OBJECT>` tag. Note that a COM object, because it is compiled code, must first pass the security challenges IE5 presents (depending on the user's security settings) before it is allowed to download or execute within the user's browser.

There is a real advantage to creating DHTML behaviors in compiled code rather than script: You can protect your code investment, because you don't ship source code with your applications. Furthermore, you can potentially gain significant performance improvements using a compiled language. Finally, compiled languages give you full access to the underlying operating system in cases

where you need tighter integration with your user's computer.

Though DHTML behaviors are a new feature, many samples are already available on Microsoft's Web site, at msdn.microsoft.com.

DEALING WITH DATA

Most substantive applications will deal with data and, as we noted, the transferring of data between browser and server has been one of the most common problems facing developers. Over the past year, Extensible Markup Language (XML) has emerged as a solution. IE5 adds an excellent XML parser, which developers can manipulate, to the object model within the browser. By interacting with the XML parser from their DHTML pages, applications can transfer data in the form of XML documents in both directions.

An XML document looks much like its HTML counterpart; each contains a set of tags that describe the information within the file. As with HTML documents, the tags define a tree of objects that is generated when an XML parser reads an XML document. This in-memory tree can be modified at runtime.

Figure 4 shows an XML document containing a list of objects, each representing an all-

This hypertext component highlights the text of any `SPAN` element it is bound to. The color is specified by the `highlightColor` property and the binding is controlled by the `styles.css` stylesheet (below).

```
<XML ID=xmlData SRC="getallstardata.asp?league=American"></XML>
<DIV ID=divBtn LANGUAGE=JavaScript onclick="return divBtn_onclick()">
  <INPUT ID=btnAmerican league=American value=American type=button>
  <INPUT ID=btnNational league=National value=National type=button>
</DIV>
<SCRIPT LANGUAGE=JavaScript>
function divBtn_onclick() {
  xmlData.src = "getallstardata.asp?league=" + event.srcElement.league;
}
</SCRIPT>
```

5 This is an XML-based remote procedure call. Depending on which button the user clicks, the `divBtn_onclick()` function will pass either "American" or "National" as a parameter to `getallstardata.asp`.

```
<?xml version="1.0"?>
<?xml:stylesheet type="text/xsl" href="transform.xsl"?>
<allstarstarters>
<allstar>
<ID>1</ID>
<Player>Ivan Rodriguez</Player>
<Position>C</Position>
<Team>Texas</Team>
<Votes>3012549</Votes>
<Nice>True</Nice>
<League>A</League>
</allstar>
<allstar>
<ID>2</ID>
<Player>Jim Thome</Player>
<Position>1B</Position>
<Team>Cleveland</Team>
<Votes>1193823</Votes>
<Nice>True</Nice>
<League>A</League>
</allstar>
</allstarstarters>
```

4 Fragment of an XML document that contains a list of all-star major-league baseball players.

```
<?xml version="1.0"?>
<xsl:stylesheet xmlns:xsl="uri:xsl">
  <xsl:template>
    <TD><xsl:value-of /></TD>
  </xsl:template>
  <xsl:template match="/">
    <TABLE>
    <TBODY>
    <xsl:for-each select="allstarstarters/allstar">
    <TR>
    <xsl:apply-templates/>
    </TR>
    </xsl:for-each>
    </TBODY>
    </TABLE>
  </xsl:template>
</xsl:stylesheet>
```

6 This XSL stylesheet transforms the XML data in figure 5 into an HTML table.

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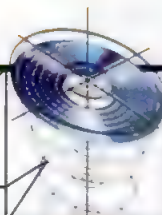
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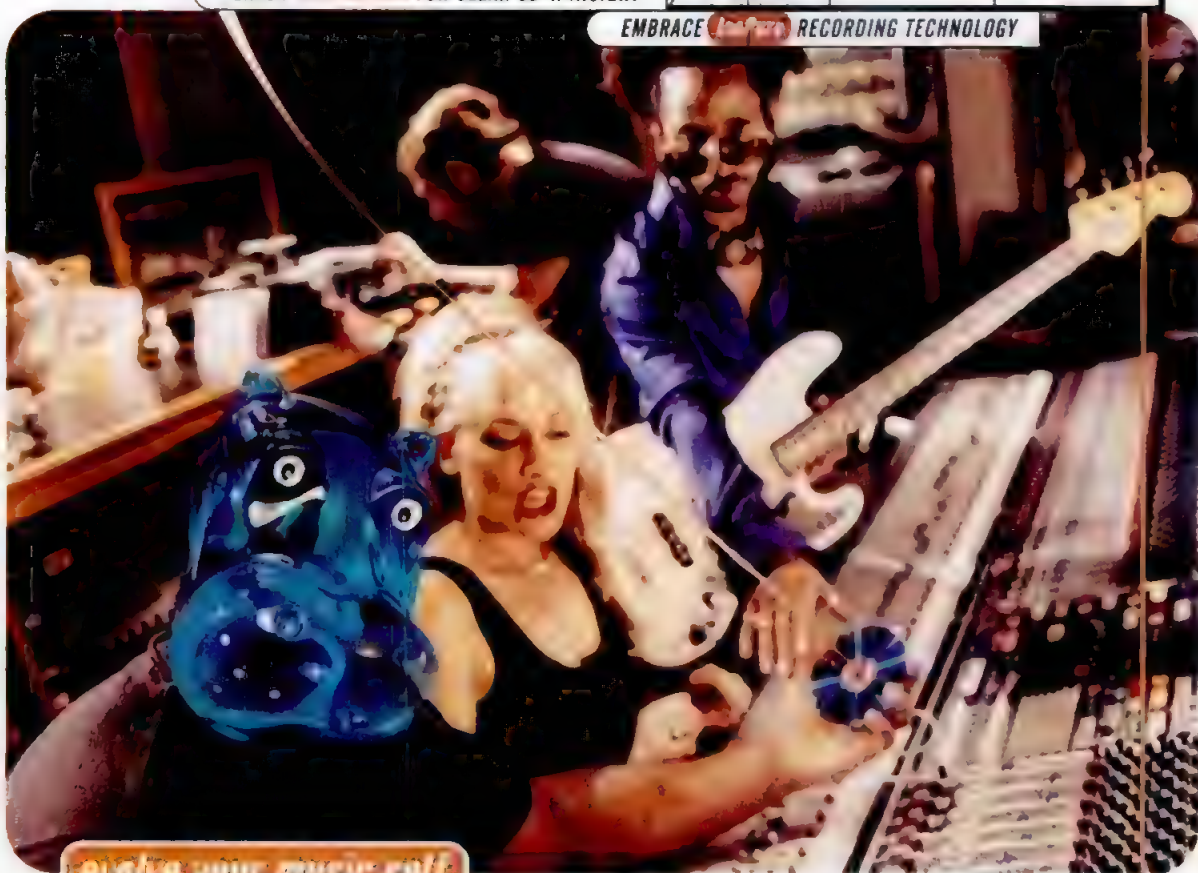
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star baseball player. When the document is read by the XML parser, the parser converts the document from the text-based format you see in Figure 5 to an in-memory object tree. In this way the process is identical to that used by HTML parsers to read an HTML document.

IE5's XML parser lets an application request additional data from a Web server *without discarding the current Web page*. Why is this so important? Today, additional data, embedded in a fresh HTML page that has been dynamically generated by scripting code on the server, is transmitted to the browser. Not only is a whole lot of redundant formatting information retrieved but, even more important, any variables storing the state of the original page must be preserved and transferred to the new page.

Since you can request additional data from a Web server without discarding the current page, you can call server-side functions from within an existing DHTML page. Take a look at the simple DHTML code in Figure 5. Let's assume a user interested in baseball all-stars clicks on the *American League* button. The button's `onclick` event handler then fires and the XML data island's `src` attribute is modified. (An *XML data island* is an HTML element that contains the actual XML for use in the HTML document, or contains a reference to a URL that contains the XML.) IE5 then issues an HTTP `GET` request, which is sent to an Active Server Page on the Web server, retrieving an XML document for the American League's all-stars. At this point, the in-memory representation of its data can be manipulated by scripting code using the `xmlData` handle, which was assigned using the `ID` attribute of the XML data island.

To display the data, you need to convert the XML into HTML, and IE5 supplies the means with the Extensible Stylesheet Language (XSL). XSL lets you write a concise set of rules in XML format that tells the XSL processor how to convert an XML source tree into an XML output tree. In most cases, the XML that is generated is actually HTML that is then rendered for display by the Web browser.

Figure 6 shows a simple XSL file that transforms the XML document shown in Figure 4 into an HTML document. Like all XSL files, this one contains a root template, the `<xsl:template match="/">` instruction. If you look at our template, you will see that we're laying out the skeleton of a document

that contains an HTML `<TABLE>` element.

What makes the rest of the stylesheet work is a set of templates that together generate the HTML document. Within the root template, the individual `<allstar>` elements in the source XML file are examined one at a time using the `<xsl:for-each select="allstarstarters/allstar">` instruction. The `<xsl:for-each>` statement generates the HTML table row `<TR>` instruction, and contains an `<xsl:apply-templates/>` statement.

When the XSL processor encounters `<xsl:apply-templates/>`, it begins looking for matches among the other templates defined in the stylesheet. A default template (one that lacks a match attribute) is defined at the top of the stylesheet. It generates the individual cells using the `<TD>` HTML tag and uses the `<xsl:value-of/>` instruction to copy the contents of the currently matched XML element to the output stream. In this case, the contents are copied into the `<TD>` element.

As you can see, XSL lets you write extremely compact rules for transforming XML input trees into XML output trees, and it lets you deal with regular documents, such as the all-star XML document presented here, as well as irregular documents that do not have such well-defined structures. Be sure to work through the excellent XML tutorial on Microsoft's Web site (msdn.microsoft.com/xml) to familiarize yourself with the power of XSL stylesheets and the features of the XML parser in IE5.

WRAPPING UP

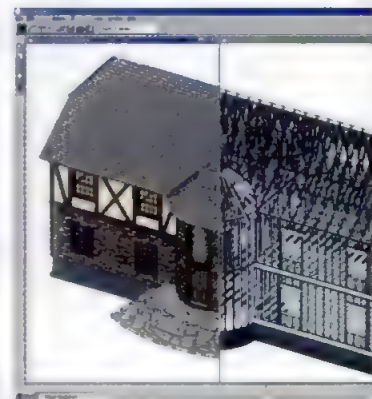
The major new features IE5 brings to application developers are XML integration and new DHTML capabilities. With the addition of XML data islands and support for XSL processing on the client, IE5 lets you write code that can call out from a Web page to request additional data. DHTML behaviors let Web developers reap the benefits of component-based programming in their applications. They can reuse components written by other developers within their own Web pages and define the behavior of elements across a family of related Web pages using Cascading Style Sheets. IE5 offers many other new developer-oriented features, such as client-side persistence, dynamic properties, and drag-and-drop support. For a detailed look, visit Microsoft's developer Web site, at msdn.microsoft.com. 

John Lam researches Web applications development issues and authored the Essential Web Applications course for DevelopMentor (www.develop.com). You can write to him at jlam@iunknown.com.

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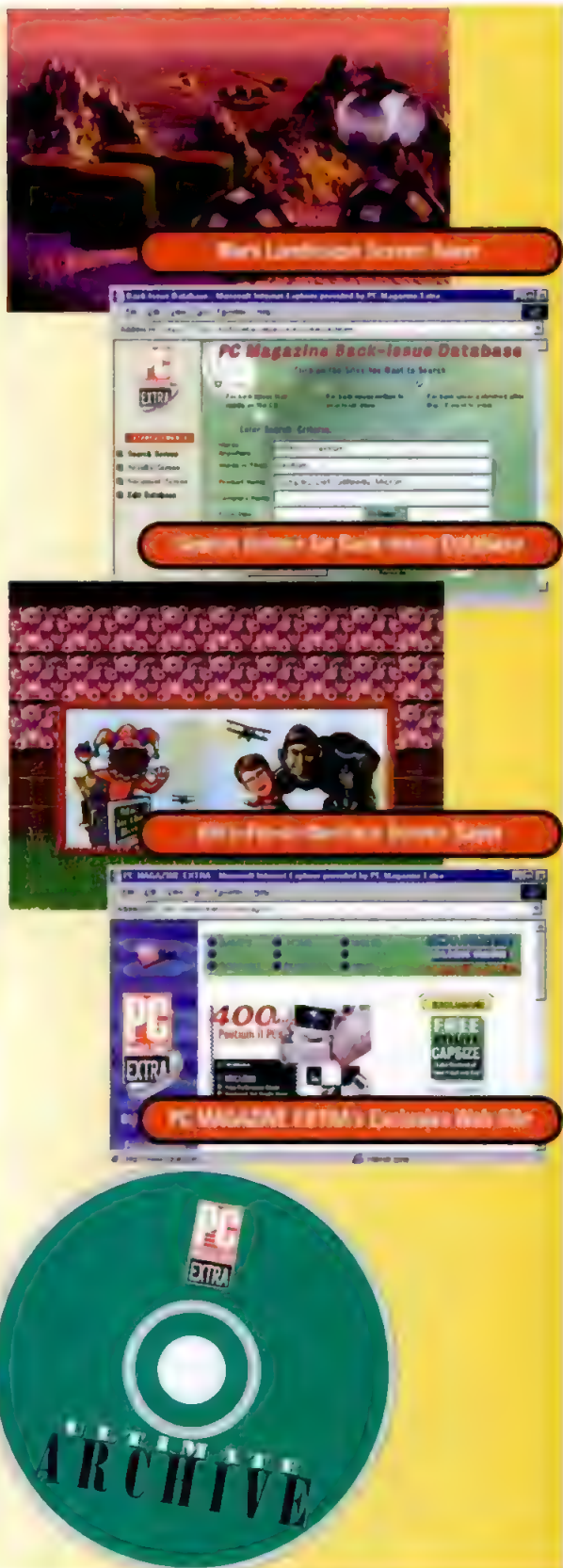
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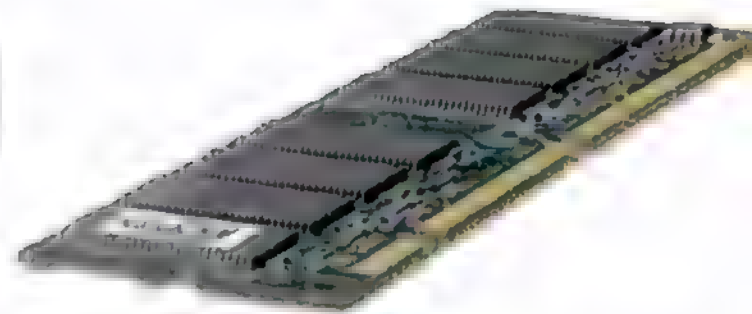
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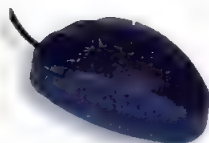


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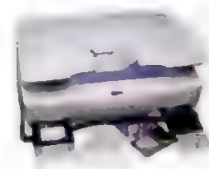
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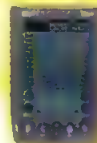


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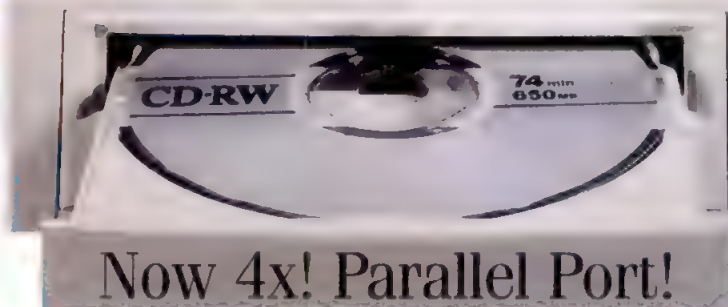
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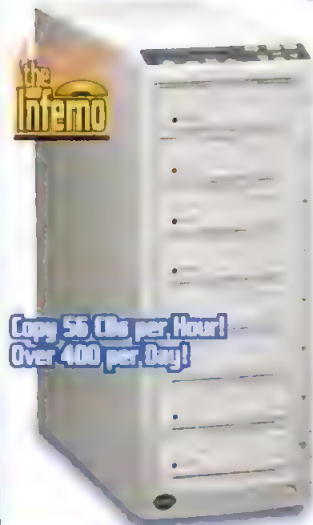
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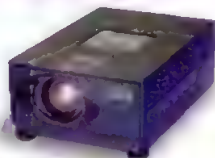
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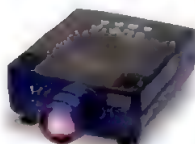


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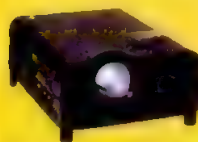
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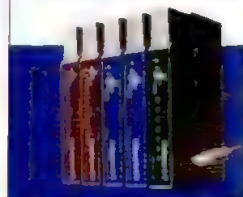
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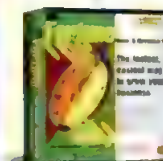
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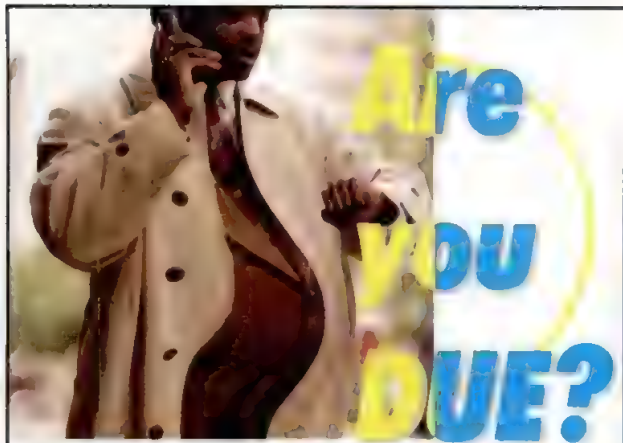
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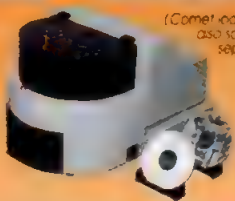
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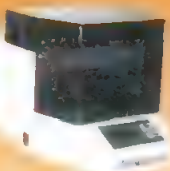
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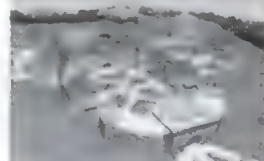
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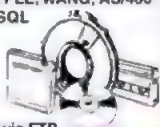
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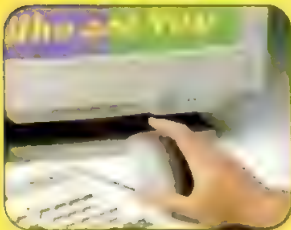
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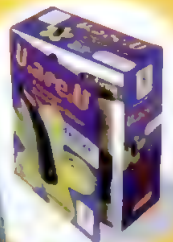
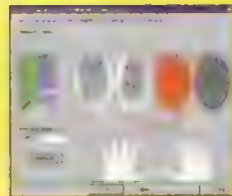
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AFTER HOURS

THE HOME SIDE OF COMPUTING

WEB FINANCING

Mortgage Web Sites

By Jan Ozer

Few homeowners escape the buying process without a story or two about the frustrations of financing. There are the calls to local lenders in order to research interest rates and the endless requests for financial data, not to mention wrestling with the financial ghosts that crop up along the way (like that unpaid phone bill from 1984). Why all the hassle? Because brokers and banks control the flow of information.

Fortunately, some new Web sites help put prospective homeowners in the driver's seat, providing fast access to multiple lenders, enabling online loan applications, and demystifying the lending process—

even for mortgage re-financing. In fact, virtually all home buyers, whether they ultimately finance their homes online or the old-fashioned way, will save time and become more financially savvy after researching mortgages on the four

Web sites we review here: *E-Loan* (www.eloan.com), *iOwn* (www.iown.com), *MSN Home-Advisor* (www.homeadvisor.com), and *QuickenMortgage* (www.quickenmortgage.com).

We chose these sites because they all let you apply for loans online and compare loans without asking you to provide personal information. As a result, you can compare mortgage rates and even obtain prequalification letters anonymously, a welcome change from brick-and-mortar lenders.

In general, both *Intuit* and *Microsoft* leverage their extensive Web histories by offering sites that provide easy access to FAQs, glossaries, and other online help tools for the prospective homebuyer. And *E-Loan* and *iOwn* are very good at helping you narrow down your loan options. Of the four sites included in this story, only *E-Loan* doesn't cover every state (though it comes pretty close).

HOW THEY WORK

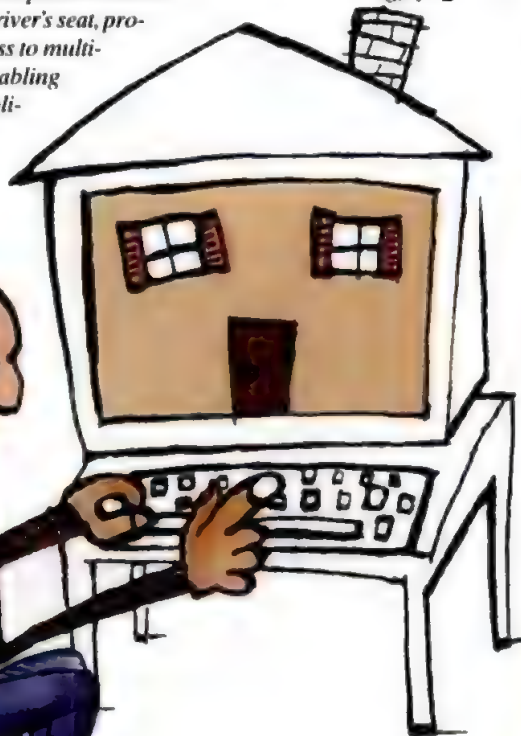
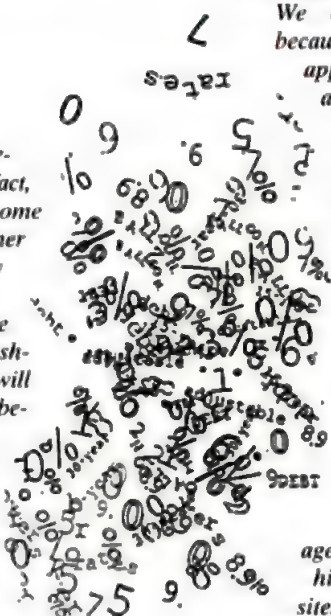
All four sites are conduits to established lenders, providing access to similar types of loans. With each of them, you complete your application online and then receive a paper loan package with information requests to complete and return to the lender. The final loan

agreement is executed at the formal house closing. The four sites represent two distinct business models, however.

E-Loan and *iOwn* are primarily mortgage brokers, similar to their traditional counterparts, which solicit your financial information and place your loan with a third-party lender, receiving a loan origination fee and an application fee at closing. All business dealings are through the broker; you never contact the lender directly.

By contrast, *MSN Home-Advisor* and *QuickenMortgage* are referral services, which act as the initial conduit between lender and borrower. These sites collect data from borrowers in order to match them with appropriate lenders. They pass data along and then step aside, allowing direct contact between borrower and lender. These sites are paid their fee after closing by the lender.

There are pluses and minuses to each approach. For example, because *E-Loan* and *iOwn* are principals for all loan transactions, they can set rules that apply to all loans and post them on their sites, providing prospective borrowers with known guidelines and procedures. These sites immediately appoint a loan officer to each account and, in the case of *E-Loan*, offer online loan tracking for instant feedback about loan status and who owes what



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AFTER HOURS

to whom, eliminating one of the most significant frustrations of the lending process.

Although MSN HomeAdvisor and QuickenMortgage deal with established, brand-name banks such as Chase Manhattan and HomeSide Lending, once you're handed over, the lender's policies and procedures apply. This means you can't look at the HomeAdvisor or QuickenMortgage Web site to understand the procedures, because these sites don't set them. In addition, though many banks may offer tools as robust as those offered by E-Loan and iOwn, you don't know this up front.

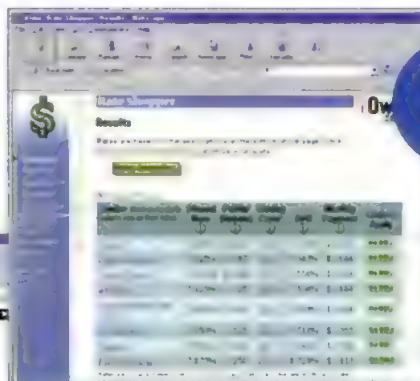
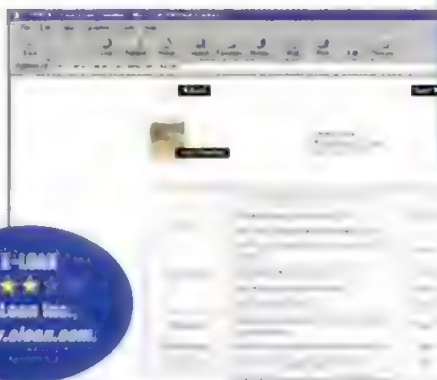
These sites differ in many other ways. To help you determine which one best fits your needs,

we compared the sites on how they handle the three major steps of the loan process—decision support, qualification, and loan selection—as well as on ease of use. Here's what we found.

DECISION SUPPORT

Shopping for a mortgage involves many decisions. You have to select the type

versus jumbo), and whether you wish to pay *points*—money up front—in order to obtain a lower interest rate.



Though all four sites offer significant decision-support tools, none excel across the board. For example, E-Loan provides an excellent worksheet for determining which type of loan to apply for, but it can't calculate the maximum loan you would qualify for given your income, expenses, and down payment. Similarly,

MSN HomeAdvisor, which provides the best overall information, offers an invaluable loan application checklist that lists all the documents you'll need to submit with the loan application, along with excellent calculators for the rent-versus-buy decision and for deciding when to refinance. You can't easily calculate monthly payments on different loan amounts, however.

You'll get the best results by cherry-picking from the different sites. If you're not sure you're ready to buy, MSN HomeAdvisor's rent-versus-buy calculator helps identify the right financial decision. If you're worried about your credit, worksheets at both iOwn and QuickenMortgage can help you assess the situation and tell you where to call to get credit reports. If you're trying to determine which type of loan to apply for, try the comprehensive and illuminating worksheets at E-Loan and QuickenMortgage.

To determine monthly payments quickly for a particular loan amount, interest rate, and duration, check out the payment calculator at E-Loan. If you're short on down-payment funds but want to avoid the private mortgage insurance (PMI) typically required if you don't put down 20 percent of your home's price, have a look at iOwn's down-payment options area. The site also does a very thorough job of explaining and estimating closing costs; and MSN HomeAdvisor and QuickenMortgage can compare your current loan with available loans to determine whether it makes sense to refinance.

Surprisingly, although all four sites detail your monthly payments, none computes the tax benefits of deducting the interest on your mortgage. You can ascertain these benefits at a

Virtual Banking

Most of us have been banking the same way for so long that we never consider the alternatives. Check your personal bank statement and chances are you'll find you're paying service fees on your checking account and earning only 1 percent or less in interest.

At Net.B@nk (www.netbank.com), an online bank based in Alpharetta, Georgia, you can earn 3 percent interest with free checking, ATM transactions, and a check card, in addition to unlimited online bill payments (a service you usually pay for with traditional banks), all with no minimum balance requirement. Or you can pay a \$4.50 service charge per month and earn 3.93 percent. At Telebank (www.telebank.com), based in Arlington, Virginia, you'll earn 3.1 percent with the same feature set, but you'll need at least \$2,500 in your account to earn interest and avoid a \$5.00 per month service charge.

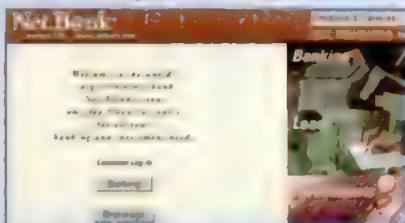
Both banks claim that as virtual banks, they save on the overhead of main and branch offices

and pass the savings to their customers. For example, Net.B@nk pays 5.0 percent on money market accounts and Telebank pays 4.8, compared with the 1.74 you'll get from NationsBank.

You can view your statement online at any time, and you'll receive monthly statements in the mail. Both banks offer telephone support, and all deposits are FDIC-insured.

Currently you can download CSV (comma-delimited) files to import into Microsoft Money or Quicken with Net.B@nk, and the company plans to begin beta-testing direct account manipulation with Money and Quicken in late August. Telebank lets you export to and from Money and Quicken.

The downsides? If you visit your ATM frequently, you'll end up paying a service charge. And every once in a while, traditional banks are useful, as when you have a large check to cash or need more money than your ATM can disburse. Also, neither online bank returns your checks after they've been processed, though Telebank will send you photocopies.



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We examine how well the sites provide **decision support** for calculating what you need to borrow and deciding whether you want to pay points up front. Borrowers want to know if they can really get loans they apply for; we take this into account when rating the sites on **qualification**, as well as how clearly each site presents the qualification process. For **loan selection**, we like sites that display only those loans you would qualify for. In judging **ease of use** we favor well-documented, easy-to-navigate sites with instant access to FAQs, glossaries, and other tools.

	E-Loan	iOwn	MSN Home-Advisor	Quicken-Mortgage
Decision support	Good	Good	Excellent	Good
Qualification	Excellent	Good	Good	Good
Loan selection	Fair	Good	Good	Excellent
Ease of use	Good	Good	Good	Excellent

site called Lending Tree (www.lendingtree.com).

QUALIFICATION

After these preliminaries, it's time to start the qualification process, which involves three separate stages: prequalification, preapproval, and final approval.

A prequalification letter essentially states that a borrower qualifies for a specific loan, according to the information provided. Since this automatically generated letter doesn't commit the lender, it is of little value to either you or the seller.

By contrast, a preapproval letter states that the lender has verified your income, debt, and credit rating, and has tentatively approved a decision to lend you the amount you've requested. This type of letter is tremendously useful, because it assures the seller that you can obtain financing after signing a purchase agreement. Then, contract in hand, you apply for final loan approval, which is generally contingent on an appraisal verifying the value of the home.

In ranking the sites, we considered several criteria. First, though prequalification provides little value to sellers, borrowers want an accurate assessment of their ability to obtain the loan applied for. Significantly, iOwn is the only site that evaluates your credit history

before issuing a prequalification letter. This is very important, because many lenders boost rates when working with borrowers with poor credit histories.

We also looked at how

MSN HOMEADVISOR
★★★★★
Microsoft Corp.,
www.homeadvisor.com

clearly each site presents the qualification process. Not surprisingly, the two brokerage sites, E-Loan and iOwn, explain the process most clearly; as brokers, they actually perform all three operations. By contrast, MSN HomeAdvisor and QuickenMortgage can issue prequalification letters, but the actual lender issues both preapprovals and final approvals.

Neither MSN HomeAdvisor nor QuickenMortgage discusses preapproval, because it's handled by the lender, but prequali-

fication procedures are clearly stated. Microsoft called the process *qualification*, a confusing misnomer that should be fixed by the time you read this.

We also liked the fact that the brokerage sites assign a loan specialist to each application on receipt. In addition, E-Loan is committed to responding to preapproval requests within four business days, and it provides online tracking of information requests and the status of loans, an outstanding feature. Because they are not brokers, both MSN HomeAdvisor and QuickenMortgage simply hand off all future communications to the chosen lender.

One great feature common to all sites is a low up-front fee compared with some traditional mortgage brokers or banks, which charge customers up to \$400 just to apply for a mort-

gage. Though QuickenMortgage charges \$250 to get started, when you actually apply for the loan this amount is transferred to the lender as a credit against credit report and appraisal fees; it's refunded if the loan doesn't go through. E-Loan charges you \$50 once you apply, in order to acquire your credit report, and there are no charges for applying with iOwn or MSN HomeAdvisor, though you'll have to pay to have your dream home appraised on all three sites, which can cost anywhere from \$200 to \$400.

Of course, low up-front costs

don't stop each site from profiting. On our \$260,000 loan, QuickenMortgage received \$1,040 (0.4 percent), paid at closing directly by the lender. MSN HomeAdvisor charges different fees with each lender and wouldn't share that information with us, but the fees are paid by the lender and disclosed at closing.

As the buyer, you pay the loan origination fees with E-Loan, which charges 0.625 percent and a \$250 processing fee—a total of \$1,875 for our \$260,000 loan. iOwn is a bit less expensive, charging a 0.5 percent "orientation fee" plus \$400 for processing; a total of \$1,700 for our loan.

LOAN SELECTION

After you complete the loan qualification worksheets, each site lists the loans for which you're eligible. In rating the sites on loan selection, we considered several factors. One key factor was whether the site displayed only those loans for which you would likely qualify, which we call "available" loans, so you don't waste time comparing irrelevant lenders and rates.

We also considered whether the site accepts borrower preferences regarding points and down payments, enables sorting and side-by-side comparisons of available loans, or provides an accurate estimate of closing costs. Once again, although each site has its highlights, none provide one-stop solutions.

For example, we like the way QuickenMortgage lets you enter "soft" preferences, such as the lowest possible interest rate rather than a specified loan amount. Similarly, you can sort loans according to which offers the lowest possible down payment instead of entering this as a fixed percentage of the purchase price. QuickenMortgage ranks loans based on preferences like lowest monthly payment or least cash required at closing, but it doesn't offer side-by-side comparisons. Its good-faith estimate of closing costs was a very thor-

AFTER HOURS

ough, solid assessment.

MSN HomeAdvisor also accepts hard and soft preferences for points and down payments and presents available loans in a spreadsheet format that offers exceptional sorting and side-by-side loan comparison capabilities. Its closing-cost estimates exclude most local costs like transfer and mortgage

taxes, however, providing an incomplete picture of how much cash you'll need.

iOwn accepts no user preferences regarding down payment or points versus interest rate. And unlike with MSN HomeAdvisor and QuickenMortgage, with iOwn you can compare only similar loans, such as 30-year fixed or 7-year adjustable-

rate mortgages, using simple loan-sorting capabilities. Closing-cost estimates are comprehensive, however, addressing all the major items, such as attorneys' fees and transfer and mortgage taxes.

Like iOwn, E-Loan doesn't let you perform custom sorts. But the real problem is that although the site checks your income and

expenses before providing a pre-qualification letter, it doesn't use this data to identify available loans (those you're likely to qualify for). This means that in many cases, some of the displayed loans may not be available to you, which wastes everybody's time. This diminishes the value of the site's comprehensive estimate of closing costs, simple loan-sorting capabilities, and useful if somewhat academic side-by-side loan comparisons.

Mortgage Web Sites

	E-Loan	iOwn	MSN HomeAdvisor	QuickenMortgage
☒ YES ☐ NO				
Business model	Broker	Broker	Referral	Referral
Coverage	All 50 states except HI, IL, KY, ME, MO, OK, RI, SC, VA	All 50 states and DC	All 50 states and DC	All 50 states and DC
Preapproval	☒	☒	N/A	N/A
Online loan tracking	☒	☐	☐	☐
Application fee	\$50 plus appraisal fee	Appraisal fee	Appraisal fee	\$250 (applied to appraisal and credit report fees)
Brokerage fee	0.625%	0.5%	Info not available	0.4% (paid by lender)
Processing fee	\$250	\$400	N/A	N/A
Complete estimate of closing costs	☒	☒	☐	☒
Flexible preferences for loan selection	☐	☐	☒	☒
Side-by-side comparison	☒	☐	☒	☐

All four sites offer prequalification letters and loan sorting.

N/A—Not applicable: The site does not act as a broker.

EASE OF USE

Finally, we also assessed each site's ease of use, both in general use and in searching for information on issues such as how to avoid paying private mortgage insurance. In general, both Intuit and Microsoft showed their Web site development experience with well-documented, easy-to-navigate sites that provide instant access to FAQs, glossaries, and other online help tools.

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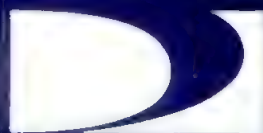
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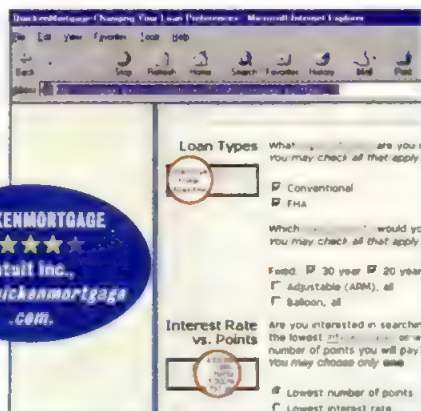
AFTER HOURS

We liked MSN HomeAdvisor's online Advisor, which provides an extensive list of helpful tips, Q&A topics, and guides on a range of subjects, such as how to negotiate the best financing agreement and how to deal with bad credit. We would have liked to see search functions on QuickenMortgage's home page, but you can search the site from www.quicken.com. QuickenMortgage displays its toll-free number virtually everywhere, giving you that "we're open and we want your business" feeling.

Both E-Loan and iOwn present the process very clearly, but additional information is difficult to access. iOwn offers a glossary and a helpful search tool, but the online content could use better indexing. Finally, E-Loan offers a simple FAQ section but no glossary, and it was the only site where we

couldn't search for the popular 80/10/10 financing method for avoiding PMI, though the information was available if you scoured the site for it.

Both sites made some rookie



errors. iOwn's mortgage application was hard to navigate, lacking the tabs provided by MSN HomeAdvisor and QuickenMortgage, so if you wanted to change information on page 5 you had to scroll through the first

four pages. Unlike the other sites, E-Loan doesn't retain data entered during previous visits until you actually file your application, which means lots of repetitive data entry if you don't complete your application during your first visit.

THE CLOSING

Each site configures its loans a bit differently, and most prices, rates, and terms shown are starting points for future negotiations, not the bottom line. This makes it difficult to ascertain which of the four sites offers the best loan, or even whether that loan saves money over those offered by traditional lenders.

What you will save is boatloads of time, since you can answer most questions and perform preliminary calculations

online, such as figuring out your creditworthiness and the largest loan for which you qualify. Another key benefit is the ability to experiment with variables such as loan duration and type, down payment, and points to find the best loan, all without speaking to a loan officer. You also get a good estimate for closing costs and competitive interest rates and terms. This is helpful whether you apply online or go through a traditional mortgage broker and bank.

Knowledge is power, and these sites help you get up to speed much faster and more objectively than you would by consulting a loan officer or mortgage broker. Though we can't say you'll get the cheapest loan online, we can say that these sites provide the tools and the data to help you get the best deal possible from whatever lending source you ultimately choose.

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PC Magazine, ISSN 0898-8507, is published twice a month except in July and August at \$49.97 for one year. Ziff Davis Inc., 28 E. 28th St., New York, NY 10016-7930. Periodicals postage paid at New York, NY 10016-7930 and at additional mailing offices. POSTMASTER: Address changes to *PC Magazine*, P.O. Box 54093, Boulder, CO 80328-0933. The Canadian GST registration number is 14049 6720 RT. Canada Post International Publications Mail Product (Canadian Distribution) Sales Agreement No. 266477. Printed in the U.S.A.

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Every Saga Has an End

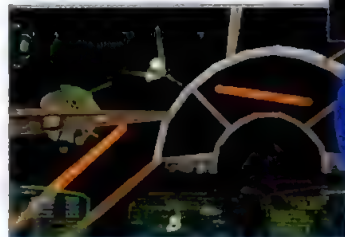
By Michael E. Ryan

As *Star Wars* mania grips the nation once again, LucasArts brings the curtain down on one of the most successful and popular gaming series of all time. *Star Wars: X-Wing Alliance* is the concluding chapter in the *X-Wing* series, which began in 1993 with the original *X-Wing* game.

The previous title, *Star Wars: X-Wing vs. TIE Fighter*, was intended strictly as a multiplayer game, but *X-Wing Alliance* returns to the roots of the series with a strong single-player game built around an intriguing story line. You play Ace Azzameen, budding space pilot and youngest member of a family trying to maintain its profitability and neutrality amid growing tensions between

the Galactic Empire and the Rebel Alliance. Unfortunately, your family is forced to take sides when the rival Viraxo family teams up with the Empire to run your family out of the galaxy.

From that point on you are a fighter pilot for the rebels, though you frequently leave behind the war effort to fly with



your family against Viraxo ships and installations. This combination of personal and global conflicts adds a *Godfather*-like ele-

ment to the classic *X-Wing* dog-fight formula.

Basic game play boils down to a series of approximately 50 missions, in which you pilot a fighter or small freighter against hostile ships and bases.



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If you make it through the entire game unscathed, you will get the

chance to pilot Han Solo's Millennium Falcon in an attack on the second Death Star in the Battle of Endor.

The 3-D-accelerated graphics, always a strength of the *X-Wing* games, are simply phenomenal. Sound effects, music, and radio chatter are all top-notch and add to the sense of immersion the game creates.

Multiplayer mode is solid, with good performance over the Internet—as long as you have a good connection and a fast system to host each gaming session. *X-Wing Alliance* also includes a mission editor that lets you create your own massive space battles, which can involve nearly 100 ships.

Though we hate to see the end of the *X-Wing* games, *Star Wars: X-Wing Alliance* is the ultimate send-off for the series. Great graphics, fantastic game play, and a killer multiplayer mode make this the best game of the series by far and a must-have for *Star Wars* fans eager for one last taste of the original saga. **PC**

EDITORIAL PRODUCT INDEX

Product Company	Page No.	Product Company	Page No.
AutoCAD 2000 Autodesk Inc.....	49	Microsoft Windows 98 Second Edition Microsoft Corp.....	39
Brother MP-21C Mobile Color Ink Jet Printer Brother International Corp.....	48	Microsoft Windows 2000 Beta 3 Microsoft Corp.....	37
Canoma MetaCreations Corp.....	53	Microsoft Windows 2000 Small Business Tools Microsoft Corp.....	48
CareerSteps Mindsteps.....	71	MSN HomeAdvisor Microsoft Corp.....	306
Compaq A900 All-In-One Compaq Computer Corp.....	66	Net.B@nk Net.B@nk Inc.....	304
CorelDraw 9 Corel Corp.....	60	Netscape Communicator 4.6 Netscape Communications Corp.....	56
Cult3D Cycore Computers.....	71	Opera 3.60 Opera Software.....	56
Deep Paint Right Hemisphere.....	64	PictureTaker Express 2.0 LANovation.....	75
ELetter Eletter Inc.....	57	QuickenMortgage Intuit Inc.....	310
E-Loan E-Loan Inc.....	304	StarGazer 1800 Router Pivotal Networking Inc.....	75
eStore Builder for Drumbeat 2000 Elemental Software.....	53	Star Wars: X-Wing Alliance LucasArts Entertainment.....	314
HP OfficeJet R60 Hewlett-Packard Co.....	66	SuperScout 2.5 surfControl, a division of JSB Corp.....	77
IBM ThinkPad 240 IBM Personal Systems Group.....	44	Telebank Telebank Financial Corp.....	304
iOwn iOwn Inc.....	304	TextBridge Pro 9.0 ScanSoft Inc.....	64
		3Com NBX 100 Communications System 3Com/NBX Corp.....	76

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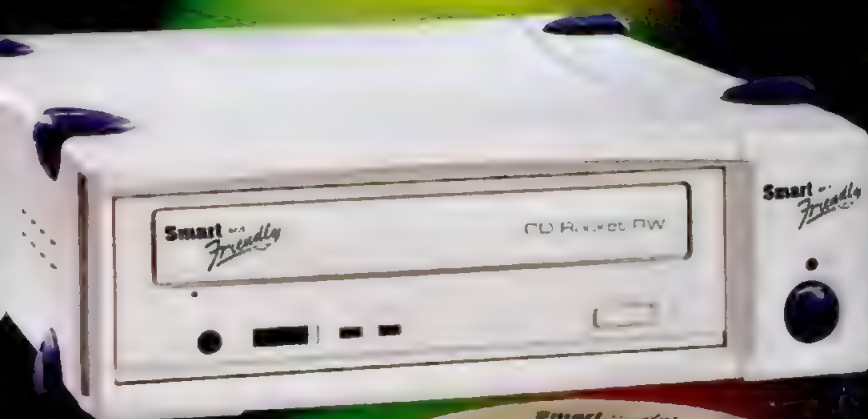
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Advertiser	Page	Advertiser	Page	Advertiser	Page
Access Software	307	EXP Computer	263	Mitsubishi Electronics	62-63
ACS Innovations	225	Extensis Corporation	95	NEC Technologies	136
Advanced Micro Devices	16-17	EZ-Lock, Inc.	135	NEC Computer Systems.....	207
American Power Conversion.....	245-247	fatbrain.com	68-69	NetObjects.....	231-233
American Power Conversion.....	311-313	firstsource.com	280-281	New Tech.....	14
Anthro Corporation.....	94	Ford Motors	108A-108L	Nokia	25
Appian Graphics	182	Fujitsu PC Corporation	139-141	Okidata	181
Argon Technologies	278	Future Power	266	Onstream.....	186
ART, Inc.....	269	Future Power	268	Optiquet.....	143
AT & T.....	250	Gateway.....	36A-36H	Oracle Corporation.....	11
ATI Technologies	194	Genicom	270	PC Power & Cooling Systems.....	88
BOLData	70	Goodyear.....	96	Plextor.....	271
Buy.Com.....	282-283	Hewlett Packard/Color Printers.....	40-41	Powerware.....	86
Caere Corporation.....	92	Hewlett Packard/HP Corporate PCs	58-59	Proxim, Inc.....	242
Canon Computer Systems	22-23	Hewlett Packard/HP Corporate PCs	90-91	QMS	257
Canon, USA.....	130-131	Hewlett Packard/HP Corporate PCs	148-149	Quantum	259-262
CDW Computer Centers, Inc.....	81-84	Hewlett Packard/HP Corporate PCs	150-151	RadioLAN	237
CDW Computer Centers, Inc.....	276-277	Hewlett Packard.....	173-174	Ringdale	252
Citrix Systems	228	Hewlett Packard/Laser Solutions Group.....	211	S.A.G./Storage Solutions	42-43
Compaq Computer Corporation	72-73	Hewlett Packard/Pro Curve Networking	219-221	Sceptre Technologies.....	198
Compaq Computer Corporation	188-191	Hewlett Packard/Pro Curve Networking	223	Seagate Technology.....	12-13
Compaq Computer Corporation	193	IBM Corporation.....	65	Silicon Graphics	165
Compaq Computer Corporation	195	IBM Corporation.....	67	Silicon Graphics	167
Compaq Computer Corporation	197	iiyama North America	119	Smart and Friendly	317
Compaq Computer Corporation	199	Infocus	185	Sony Direct.....	48A-48H
Compaq Computer Corporation	202-205	Innovative Software	163	Sprint PCS.....	15
Corel Corporation	8	Intel Corporation	32-33	Symantec Corporation	153-156
Corel Corporation	107	Interland Corp.....	192	TDK	267
Corel Corporation	178	Jeep	5	TigerDirect.....	322-323
Creative Labs.....	50-51	Kingston Technology Corporation.....	112	Tivoli Systems.....	98-99
Crucial Technology	18-19	LG Electronics USA	105	Toshiba.....	26-27
Crucial Technology	275	Lincoln - Ford Motor	60A-60B, 61	Tripp Lite	238
Deja.com	20	Macromedia.....	159	Unicom Electric, Inc.	227
Dell Computer Corporation	C9-C12	Macromedia.....	161	Value America	54-55
Dell Computer Corporation	121-128	MAG InnoVision.....	111	Vega Technologies	216
Dell Computer Corporation	279	Matrox Graphics, Inc.	145	Verio Inc.....	226
Deneba Software	201	Meridian Data	235	Veritas Software Corp.....	52
Diamond Multimedia Systems	117	Micro Solutions	285	ViewSonic Corporation	74
Digital Persona	302	Micron Electronics.....	C2-C8, 1	Vinca Corporation.....	224
Dirt Cheap Drives.....	274	Microsoft.....	2-3	VISA	31
Elsa, Inc.....	34	Microsoft.....	45-47	Visioneer	215
Epson America	78-79	Microsoft.....	212-213	Winbook	305
Executive Software	249	MindSpring.....	255		

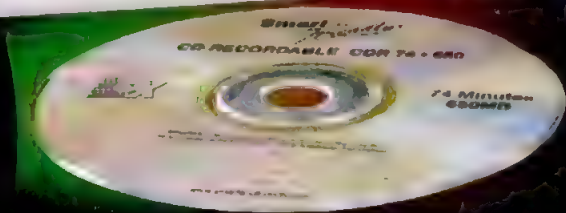


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Company	Product	Page
ACCELERATOR BOARDS		
Applan Graphics	Graphic Cards	182
Diamond Multimedia Systems	Viper V770	117
Eisa, Inc.	Erazor III	34
Matrox Graphics, Inc.	Millennium G400	145
ADD-ON BOARDS		
Applan Graphics	Graphic Cards	182
Creative Labs	Multimedia Upgrades	50-51
Diamond Multimedia Systems	Viper V770	117
ANTI-VIRUS SOFTWARE		
Symantec Corporation	Norton Antivirus and Norton Utilities	153-156
BACKUP SOFTWARE		
American Power Conversion	Smart UPS Rack Mount	245-247
American Power Conversion	Back-UPS Line	311-313
Dirt Cheap Drives	Mass Storage	274
Tripp Lite	SmartPro UPS Systems	238
VERITAS Software Corp.	Backup Exec	52
BOOKS		
fatbrain.com	Computer Books	68-69
CD-ROM		
EXP Computer	DVD Traveler	263
New Tech	Backup	14
Plextor	PlexWriter	271
Smart and Friendly	CD Rocket Bx CD Recorder	317
CELLULAR PHONES		
Nokia	FoneSync	25
CHIPS/PROCESSORS		
Advanced Micro Devices	K6 3D	16-17
Intel Corporation	Home Networking Products	32-33
CLIENT SERVER SOFTWARE		
Citrix Systems	MetaFrame	228
COMPUTER FURNITURE		
Arthro Corporation	Technology Furniture	94
COMPUTERS/DESKTOPS		
BOLData	Adventure Series Workstations	70
CDW Computer Centers, Inc.	Hardware	276-277
CDW Computer Centers, Inc.	Hardware	81-84
Compaq Computer Corporation	Compaq Computer Corporation	188-191
Compaq Computer Corporation	Compaq Computer Corporation	193
Compaq Computer Corporation	Compaq Computer Corporation	195
Compaq Computer Corporation	Compaq Computer Corporation	197
Compaq Computer Corporation	Compaq Computer Corporation	199
Compaq Computer Corporation	Compaq Computer Corporation	202-205
Compaq Computer Corporation	Compaq Computer Corporation	72-73
Dell Computer Corporation	Notebooks, Dimension & Servers	C9-C12
Dell Computer Corporation	Notebooks, Dimension & Servers	121-128
Dell Computer Corporation	Refurbished Desktops/Notebooks	279
firstsource.com	Internet	280-281
Future Power	Signature Series	266
Future Power	Advantage Series	268
IBM Corporation	IBM Commercial Desktop	67
Micron Electronics	Micron Family of Products	C2-C8, 1
S.A.G./Storage Solutions	Servers and Storage	42-43
Silicon Graphics	Silicon Graphics Systems	165
Silicon Graphics	Silicon Graphics Systems	167
TigerDirect	TigerDirect	322-323
Toshiba	DKT Desktop	26-27
Value America	Computer Systems	54-55
Winbook	Winbook 400 MHz	305

DATA COMPRESSION HARDWARE		
Executive Software	Diskeeper	249
firstsource.com	Internet	280-281

DISK/TAPE DRIVES		
Micro Solutions	Backpack CD-Rewriter	285
Onstream	30GB & 50GB Digital Tape Drive	186
Quantum	Data Storage	259-262
Seagate Technology	Mass Storage	12-13
Smart and Friendly	CD Rocket Bx CD Recorder	317

E-COMMERCE		
Value America	Computer Systems	54-55
VISA	E-Commerce	31

ENTERTAINMENT SOFTWARE		
Access Software	Links LS Golf	307

GRAPHICS SOFTWARE		
Deneba Software	Canvas 8	201
Macromedia	Dreamweaver 2.0	159
Macromedia	Dreamweaver 2.0	161

HARD DRIVES		
New Tech	Backup	14
Quantum	Data Storage	259-262
Seagate Technology	Mass Storage	12-13

HARDWARE		
ACS Innovations	CD Master Pro	225
Argon Technologies	Argon Monitors	278
Canon Computer Systems Inc.	BJC-6000	22-23
Creative Labs	Multimedia Upgrades	50-51
Dell Computer Corporation	Refurbished Desktops/Notebooks	279
Diamond Multimedia Systems	Viper V770	117
Digital Persona	U are U	302
Dirt Cheap Drives	Mass Storage	274
Eisa, Inc.	Erazor III	34
Epson America	EPSON Stylus Color Printers	78-79
EXP Computer	DVD Traveler	263
firstsource.com	Internet	280-281
Fujitsu PC Corporation	LifeBook, B Series	139-141
Future Power	Signature Series	266
Future Power	Advantage Series	268
Gateway	Notebooks, PCs, Mail Order, Peripherals	36A-36H
Infocus	DLP Projector	185
Intel Corporation	Home Networking Products	32-33
MAG Innovation	Monitors	111
Matrox Graphics, Inc.	Millennium G400	145
Mendian Data	SNAP	235
Mitsubishi Electronics	Monitors	62-63
NEC Computer Systems	PowerMate Desktops	207
Onstream	Digital LED Printer	181
Onstream	30GB & 50GB Digital Tape Drive	186
Optquest	Optquest V95 19" Monitor	143
Plextor	PlexWriter	271
Quantum	Data Storage	259-262
Radiolan	Wireless networking	237
S.A.G./Storage Solutions	Servers and Storage	42-43
Sceptre Technologies	Sceptre Sounda 6500 Notebook	198
Silicon Graphics	Silicon Graphics Systems	165
Silicon Graphics	Silicon Graphics Systems	167
Smart and Friendly	CD Rocket Bx CD Recorder	317
Sony Direct	Sony VAIO Notebooks	48A-48H
TigerDirect	TigerDirect	322-323
Toshiba	DKT Desktop	26-27
Value America	Computer Systems	54-55
ViewSonic Corporation	VP 150 Monitors	74
Visioneer	PaperPort D Touch Scanner	215

HUBS		
Hewlett Packard Pro Curve Networking	HP ProCurve Switches	219-221
Hewlett Packard Pro Curve Networking	HP ProCurve Switches	223
UNICOM Electric, Inc.	SOHO Nenetwork Family	227
Vega Technologies	LAN/HUB Cloning Device	216

INTERNET		
ACS Innovations	CD Master Pro	225
Buy.Com	Internet	282-283
Deja.Com	Deja.com	20
Macromedia	Dreamweaver 2.0	159
Macromedia	Dreamweaver 2.0	161
Microsoft	Microsoft Press	212
MindSpring	MindSpring Internet Services	255
NetObjects	Fusion 4.0	231-233
TDK	TDK	26
Value America	Computer Systems	54-55

LOCAL AREA NETWORKING		
CDW Computer Centers, Inc.	Networking Products	276-277
CDW Computer Centers, Inc.	Networking Products	81-84

Company	Product	Page
firstsource.com	Internet	280-281
Silicon Graphics	Silicon Graphics Systems	165
Silicon Graphics	Silicon Graphics Systems	167
Vega Technologies	LAN/HUB Cloning Device	216

MAIL ORDER

CDW Computer Centers, Inc.	Mail Order	278-277
CDW Computer Centers, Inc.	Mail Order	81-84
Dell Computer Corporation	Refurbished Desktops/Notebooks	279
Dirt Cheap Drives	Mass Storage	274
firstsource.com	Internet	280-281
Gateway	Notebooks, PCs, Mail Order, Peripherals	36A-36H

MASS STORAGE

Dirt Cheap Drives	Mass Storage	274
Micro Solutions	Backpack CD-Rewriter	285
New Tech	Backup	14
Onstream	30GB & 50GB Digital Tape Drive	186
Plextor	PlexWriter	271
Quantum	Data Storage	259-262
S.A.G./Storage Solutions	Servers and Storage	42-43
Seagate Technology	Mass Storage	12-13
Smart and Friendly	CD Rocket 8x CD Recorder	317
VERITAS Software Corp.	Backup Exec	52

MEMORY

Crucial Technology	Memory Upgrades	18-19
Crucial Technology	Memory Upgrades	275
Kingston Technology Corporation	Memory	112

MISCELLANEOUS

Anthro Corporation	Technology Furniture	94
Buy.Com	Internet	282-283
Digital Persona	U.are.U	302
EXP Computer	DVD Traveler	263
EZ-Link, Inc.	EZ-Link	135
fatbrain.com	Computer Books	68-69
Ford Motor Co.	Automobile	108A-108I
Goodyear	Tires	96
Jeep	Jeep Wrangler	5
Lincoln-Ford Motor	Lincoln	50A-50B, 61

MONITORS

Argon Technologies	Argon Monitors	278
Hydrex North America	Monitors	119
LG Electronics USA	LG Electronics USA, Inc.	105
MAG InnoVision	Monitors	111
Mitsubishi Electronics	Monitors	62-63
NEC Technologies	CRT Monitor	136
Optquest	Optquest V95 19" Monitor	143
ViewSonic Corporation	VP 150 Monitors	74

MULTIMEDIA HARDWARE

Appian Graphics	Graphic Cards	182
ATI Technologies	Xpert 128 & Rage Fury	194
Creative Labs	Multimedia Upgrades	50-51
Gateway	Notebooks, PCs, Mail Order, Peripherals	36A-36H
Micro Solutions	Backpack CD-Rewriter	285

MULTIMEDIA SOFTWARE

Macromedia	Dreamweaver 2.0	159
Macromedia	Dreamweaver 2.0	161

NETWORK INTERFACE CARDS

AT & T	AT&T Business Services	250
--------	------------------------	-----

NETWORK SYSTEMS/EQUIPMENT

AT & T	AT&T Business Services	250
Proxim, Inc.	Proxim Symphony	242
Radiolan	Wireless Networking	237
UNICOM Electric, Inc.	SOHO Network Family	227

NOTEBOOKS/LAPTOPS/PORTABLE PCs

CDW Computer Centers, Inc.	Notebook Computers	276-277
CDW Computer Centers, Inc.	Notebook Computers	81-84
Compaq Computer Corporation	Compaq Computer Corporation	188-191
Compaq Computer Corporation	Compaq Computer Corporation	193
Compaq Computer Corporation	Compaq Computer Corporation	195
Compaq Computer Corporation	Compaq Computer Corporation	197
Compaq Computer Corporation	Compaq Computer Corporation	199

Compaq Computer Corporation	Compaq Computer Corporation	202-205
Compaq Computer Corporation	Compaq Computer Corporation	72-73
Dell Computer Corporation	Notebooks, Dimension & Servers	C9-C12
Dell Computer Corporation	Notebooks, Dimension & Servers	121
Dell Computer Corporation	Notebooks, Dimension & Servers	124
Dell Computer Corporation	Refurbished Desktops/Notebooks	279
Fujitsu PC Corporation	LifeBook, B Series	139-141
Gateway	Notebooks, PCs, Mail Order, Peripherals	36A-36H
Hewlett Packard/HP Corporate PCs	HP Vectra	148-151
Hewlett Packard/HP Corporate PCs	Kayak Workstation	58-59
Hewlett Packard/HP Corporate PCs	HP Vectra	90-91
IBM Corporation	IBM ThinkPad	65
Micron Electronics	Micron Family of Products	C2-C8, 1
NEC Computer Systems	PowerMate Desktops	207
Sceptre Technologies	Sceptre Soundx 6500 Notebook	198
Sony Direct	Sony VAIO Notebooks	48A-48H
Winbook	Winbook 400 MHz	305

ON LINE SERVICES

Deja.com	Deja.com	20
Microsoft	Microsoft Press	212

OPERATING SYSTEMS

Tivoli Systems	Tivoli Systems Inc.	98-99
----------------	---------------------	-------

PERIPHERALS

Appian Graphics	Graphic Cards	182
Canon Computer Systems	BJC-6000	22-23
Digital Persona	U.are.U	302
Hewlett Packard	Printers	211
Matrox Graphics, Inc.	Millennium G400	145
Optquest	Optquest V95 19" Monitor	143
Plextor	PlexWriter	271
Quantum	Data Storage	259-262
Seagate Technology	Mass Storage	12-13
Smart and Friendly	CD Rocket 8x CD Recorder	317
ViewSonic Corporation	VP 150 Monitors	74
Visioneer	PaperPort O Touch Scanner	215

POWER PROTECTION

American Power Conversion	Smart UPS Rack Mount	245-247
American Power Conversion	Back-UPS Line	311-313
Powerware	Powerware	86
Tripp Lite	SmartPro UPS Systems	238

PRINTER ACCESSORIES

Ringdale	PrintPro 99	252
----------	-------------	-----

PRINTERS

Canon Computer Systems	BJC-6000	22-23
Epson America	Epson Stylus Color Printers	78-79
Genicom	MicroLaser 320N	270
Hewlett Packard	HP Monochrome Laser Printer	173-174
Hewlett Packard/Laser Solutions Group	Printers	211
Hewlett Packard/Color Printers	HP Color Printers	40-41
Okidata	Digital LED Printer	181
QMS	QMS Magicolor 2	257

PROJECTORS/PANELS

Infocus	DLP Projector	185
---------	---------------	-----

RESELLERS

CDW Computer Centers, Inc.	Reseller	276-277
CDW Computer Centers, Inc.	Reseller	81-84

SCANNERS

Canon	Scanner	130-131
Visioneer	PaperPort O Touch Scanner	215

SECURITY SOFTWARE

Digital Persona	U.are.U	302
EZ-Link, Inc.	EZ-Link	135

SERVERS

Compaq Computer Corporation	Compaq Computer Corporation	188-191
Compaq Computer Corporation	Compaq Computer Corporation	193
Compaq Computer Corporation	Compaq Computer Corporation	195
Compaq Computer Corporation	Compaq Computer Corporation	197
Compaq Computer Corporation	Compaq Computer Corporation	199
Compaq Computer Corporation	Compaq Computer Corporation	202-205

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ADVERTISERS' INDEX

Company	Product	Page
Compaq Computer Corporation	Compaq Computer Corporation	72-73
Dell Computer Corporation	Notebooks, Dimension & Servers	C9-C12
Dell Computer Corporation	Notebooks, Dimension & Servers	121-128
Mendian Data	SNMP	235
Oracle Corporation	Oracle BI	11
Ringdale	PrintPro 99	252
S.A.G./Storage Solutions	Servers and Storage	47-49
Toshiba	DKT Desktop	28-27
SOFTWARE		
Access Software	Links LS Golf	307
ART, Inc.	Chief Architect	269
Caere Corporation	OmniPage Web	92
Corel Corporation	Draw 9.0	107
Corel Corporation	Paint 9	178
Corel Corporation	WordPerfect Office 2000	8
Executive Software	Diskkeeper	249
Extensis Corporation	Portfolio	96
Innovative Software	ImageCast IC3	153
Macromedia	Dreamweaver 2.0	158
Macromedia	Dreamweaver 2.0	161
Microsoft	Microsoft Office 2000 Developer	2-3
Microsoft	Office 2000	45-47
NetObjects	Fusion 4.0	231-233
TigerDirect	TigerDirect	322-323
Tivoli Systems	Tivoli Systems Inc.	98-99
Value America	Computer Systems	54-55
Venica Corporation	Y2K TimeLab	224
SOUND BOARDS		
Creative Labs	Multimedia Upgrades	50-51
SWITCHES		
Hewlett Packard/Pro Curve Networking	HP ProCurve Switches	219-221
Hewlett Packard/Pro Curve Networking	HP ProCurve Switches	223
UNICOM Electric, Inc.	SOHO Network Family	227
TELECOMMUNICATIONS		
ACS Innovations	CD Master Pro	225
Pacific Bell	Data Positioning	272-273
Southwestern Bell	Video Conferencing	177
Sprint PCS	Communications Networking	15
UTILITIES		
Executive Software	Diskkeeper	249
Innovative Software	ImageCast IC3	153
Symantec Corporation	Norton Antivirus and Norton Utilities	153-158
VIDEO/GRAPHIC BOARDS		
Aprian Graphics	Graphic Cards	182
Elisa, Inc.	Eraser III	34
Matrox Graphics, Inc.	Millennium G400	145
WEB SITE DEVELOPMENT SOFTWARE		
Hwey Technologies - Veno Company	Veno Web Hosting	226
Macromedia	Dreamweaver 2.0	159
Macromedia	Dreamweaver 2.0	161
NetObjects	Fusion 4.0	231
WEB SOFTWARE		
Caere Corporation	OmniPage Web	92
NetObjects	Fusion 4.0	231-233
WEB/INTERNET SERVICES		
Interland Corp.	Web Hosting	192
TDK	TDK	38
WINDOWS SOFTWARE		
Executive Software	Diskkeeper	249
WIRELESS NETWORK EQUIPMENT		
Proxim, Inc.	Proxim Symphony	242
RadioLAN	Wireless Networking	237
Sprint PCS	Communications Networking	15
WORKSTATIONS		
BOLDData	Adventure Series Workstations	78
Hewlett Packard/HP Corporate PCs	HP Vectra	148-151
Hewlett Packard/HP Corporate PCs	Kayak Workstation	58-59
Hewlett Packard/HP Corporate PCs	HP Vectra	90-91
IBM Corporation	IBM Commercial Desktop	87
Silicon Graphics	Silicon Graphics Systems	165
Silicon Graphics	Silicon Graphics Systems	167

For Additional Categories see MARKETPLACE PRODUCT INDEX PAGES 288-300.

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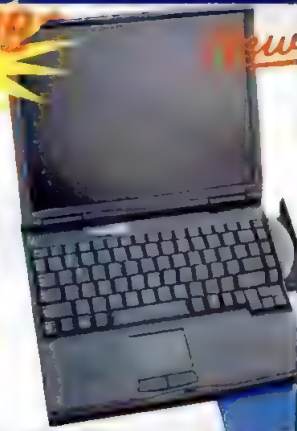
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M-741LMRT Micro-ATX
Socket 370/Slot 1
with Video, Sound,
Modem & NIC on-board

Tiger 741LMRT Form Factor: M-ATX • CPU: Socket 370/Slot 1 • Bus Speed: Up to 100MHz • On-board Video AGP 8MB • On-board Audio: YES • PCI Slots: 1 • ISA Slots: 1 (Shared) • Memory: 3 DIMM • Max Memory: 768 MB

Tiger ATX M-763VT Socket 370/ Slot 1

Motherboard
Includes:
Motherboard
with cable
and manual.

Tiger 763VT Motherboard At-A-Glance
Form Factor: ATX • CPU: Socket 370/Slot 1
• Bus Speed: Up to 100MHz • On-board Video: No
• On-board Audio: YES • PCI Slots: 4 • ISA Slots: 2
• Memory: DIMM • Max Memory: 768 MB

Tiger M-571 AT Socket 7

M-571-AT Socket 7
with 4 PCI/3 ISA
PCI Sound & PCI
Video with 4MB On-
board

Tiger 571 Form Factor: AT • CPU: Socket 7 • Bus Speed: Up to 75 MHz • On-board Video: PCI 4MB • On-board Audio: YES • PCI Slots: 4 • ISA Slots: 3 • Memory: 2 DIMM/4 SIMM • Max Memory: 128/256 MB

Tiger 5EMA+ ATX Super Socket 7

Motherboard
Includes:
Motherboard with
1MB Cache;
cables, manual

Tiger 5EMA+ Motherboard Features At-A-Glance
Form Factor: ATX • CPU: Socket 7 • Bus
Speed: Up to 100 MHz • AGP Slots: 1 • PCI
Slots: 5 • ISA Slots: 2 • Memory: 3 DIMM
Sockets • Max Memory: 768MB

Tiger M-599 Micro-ATX Socket 7 with AGP

M-599-ATX Socket 7 with
3 PCI/1 ISA, PCI Sound &
AGP Video with 8MB On-
board

Tiger 599 Form Factor: M-ATX • CPU: Socket 7 • Bus Speed: Up to 100MHz • On-board Video: AGP 8MB • On-board Audio: YES • PCI Slots: 3 • ISA Slots: 1 • Memory: 3 DIMM • Max Memory: 768 MB

Tiger 598 AT Super Socket 7 with AGP Video

Motherboards
Include:
Motherboard,
cables & manual

Tiger 598 Motherboard At-A-Glance
Form Factor: AT • CPU: Super Socket 7 • Bus Speed:
Up to 100 MHz • On-board Video: 8MB AGP • On-
board Audio: YES • PCI Slots: 3 • ISA Slots: 2
• Memory: 3 DIMM • Max Memory: 768 MB

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TC1-MEM-128	128MB PC100 SDRAM	\$99.99	\$95.99	\$91.99

Note: In addition to these low priced prices, there are many other memory products available at Tiger's. Call us today for more information and a complete list of products. All prices are subject to change without notice. *MSRP. Bulk orders may be available at a special price. Call us for details.

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Item #	Manufacturer	Size	Units	1-2	3-5	6+
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THD-6C	Seagate	6.4GB	\$124.99	\$122.99	\$120.99	\$120.99
THD-19Q	Quantum	19.0GB	\$208.99	\$199.99	\$194.99	\$194.99

MOTHERBOARD SPECIFICATIONS

Motherboard Design	Processors Supported
Tiger 571 AT including Wave Table sound and PCI video	AMD Up to K6-300 & K62-266 Intel Pentium up to 233 MMX IBM/Cyrix Up to PR333
Tiger 598 AT including 1MB Cache, Wave Table sound and PCI video	AMD Up to K6-2/450; K6-III/450 Intel Pentium up to 233 MMX IBM/Cyrix Up to PR366
Tiger 599 M-ATX including 1MB Cache, Wave Table sound and PCI video	AMD Up to K6-2/450; K6-III/400 Intel Pentium up to 233 MMX IBM/Cyrix Up to PR366
Tiger 5EMA+ Super Socket 7 1MB Cache	AMD Up to K6-2/450; K6-III-450 Intel Pentium up to 233 MMX IBM/Cyrix up to MII 366
Tiger 763VT ATX Slot 1 w/AGP Port	Celeron up to 466MHz Intel Pentium III up to 500MHz
Tiger 741LMRT ATX Slot 1 w/AGP On-board	Celeron up to 466MHz Intel Pentium III up to 500MHz

MOTHERBOARD ONLY

Item No.	1-2 units	3-5 units	6+ units
MB1-C-1B	\$75.99	\$70.99	\$65.99
MB1-E-9A	\$82.99	\$79.99	\$75.99
MB2-599	\$82.99	\$79.99	\$75.99
MB1-T-7B	\$83.99	\$78.99	\$74.99
MB2-763VT	\$79.99	\$73.99	\$69.99
MB2-741L	\$103.99	\$98.99	\$93.99



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CA1-C-1A	AT Case 9-Bay 200-W P/S	\$46.99	\$44.99	\$43.99	
CA1-C-2B	ATX Case 6-Bay 200-W P/S	\$58.99	\$54.99	\$52.99	
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AMD K6-2 Processors

Item #	Description	1-2 Units	3-5 Units	6+ units or more
#CP2-K6-300	300MHz	\$52.99	\$49.99	\$47.99
#CP2-K62-333	333 3DNow!	\$62.99	\$59.99	\$56.99**
#CP2-K62-350	350 3DNow!	\$68.99	\$65.99	\$62.99*
#CP2-K62-400	400 3DNow!	\$99.99	\$94.99	\$89.99*
#CP2-K62-450	450 3DNow!	\$135.99	\$129.99	\$122.99*
#CP2-K63-400	400 3DNow!	\$219.99	\$209.99	\$199.99*
#CP2-K63-450	450 3DNow!	\$267.99	\$249.99	\$239.99*

* Requires 64MB bus motherboard and 6ns PC100 SDRAM
** Requires 64MB bus motherboard and 6ns PC100 SDRAM

Pentium & Cyrix MII
Tiger recommends the AT or a Super Socket 7 motherboard with these processors.

Pentium & Cyrix MII

Item #	Description	1-2 Units	3-5 Units	6+ units or more
#CP2-6X300	MMI 300 CPU	\$41.99	\$39.99	\$37.99
#CP2-6X333	MMI 333 CPU	\$47.99	\$42.99	\$40.99*
#CP2-6X366	MMI 366 CPU	\$72.99	\$69.99	\$65.99*
#CP2-P233	Pentium 233 CPU	\$46.99	\$43.99	\$39.99

* Requires 64MB bus motherboard and 6ns PC100 SDRAM

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Item #	Description	Units	1-2	3-5	6+
TC1-6000	Floppy (Beige)	\$19.99	\$17.99	\$15.99	
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A216-1002	Slot 1 Fan	\$5.99	\$5.49	\$4.49	
CI-PPGA370	Celeron Slot 1 Adapter	\$8.99	\$7.99	\$7.49	

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Intel Celeron, Pentium II & III

*** Celeron CPUs are socket 370 format and require a fan and adapter. See Tiger's website for details.

Intel Celeron, Pentium II & III Processors

Item #	Description	1-2 Units	3-5 Units	6+ units or more
#CP2-CI333	Intel Celeron 333 processor**	\$78.99	\$75.99	\$72.99
#CP2-CI366	Intel Celeron 366 processor**	\$75.99	\$73.99	\$71.99
#CP2-CI400	Intel Celeron 400 processor**	\$106.99	\$99.99	\$93.99
#CP2-CI466	Intel Celeron 466 processor**	\$164.99	\$159.99	\$152.99
#CP2-P2-400	Intel Pentium II 400 processor*	\$199.99	\$189.99	\$179.99
#CP2-P3-450	Intel Pentium III 450 processor*	\$309.99	\$294.99	\$278.99
#CP2-P3-500	Intel Pentium III 500 processor*	\$549.99	\$529.99	\$499.99
#CP2-P3-550	Intel Pentium III 550 processor*	\$839.99	\$799.99	\$759.99

* Requires 64MB bus motherboard and 6ns PC100 SDRAM
** Requires 64MB bus motherboard and 6ns PC100 SDRAM

Sorry but as prices are always changing on CPUs and memory, we do not offer price protection in the event prices rise or fall. **Requires 100MHz bus motherboard and 6ns PC100 SDRAM. *** Requires 64MB bus motherboard and 6ns PC100 SDRAM. 1. CD-ROM speeds are variable, maximum speeds are shown. TT: Requires 83MHz bus motherboard. Call us for details and warranty information. No returns accepted on CPUs.

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